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ABSTRACT

New Zealand is finding itself thrust into the international economy in which new skills are required by its students in colleges and universities. This document traces the student flow from secondary schools and concentrates on the characteristics of the flow into and out of higher (tertiary) education levels. The report: (1) begins with data on New Zealand population trends which may influence secondary and tertiary education; (2) illustrates the marked drop-off from secondary to certain tertiary levels by sex and by type of school (coed or single sex); (3) shows the spread of subject choice by sex and by type of school; (4) presents mathematics-science subject combinations by sex and by type of school; (5) indicates trends in subject selection which have implications for tertiary education and employment prospects; and (6) provides information on graduation patterns, tertiary sources, and the output of technological skills. (TW)

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ED 294 741

Certech

The secondary - tertiary
student flow 1979 - 1986;
and the implications for
a changing economy

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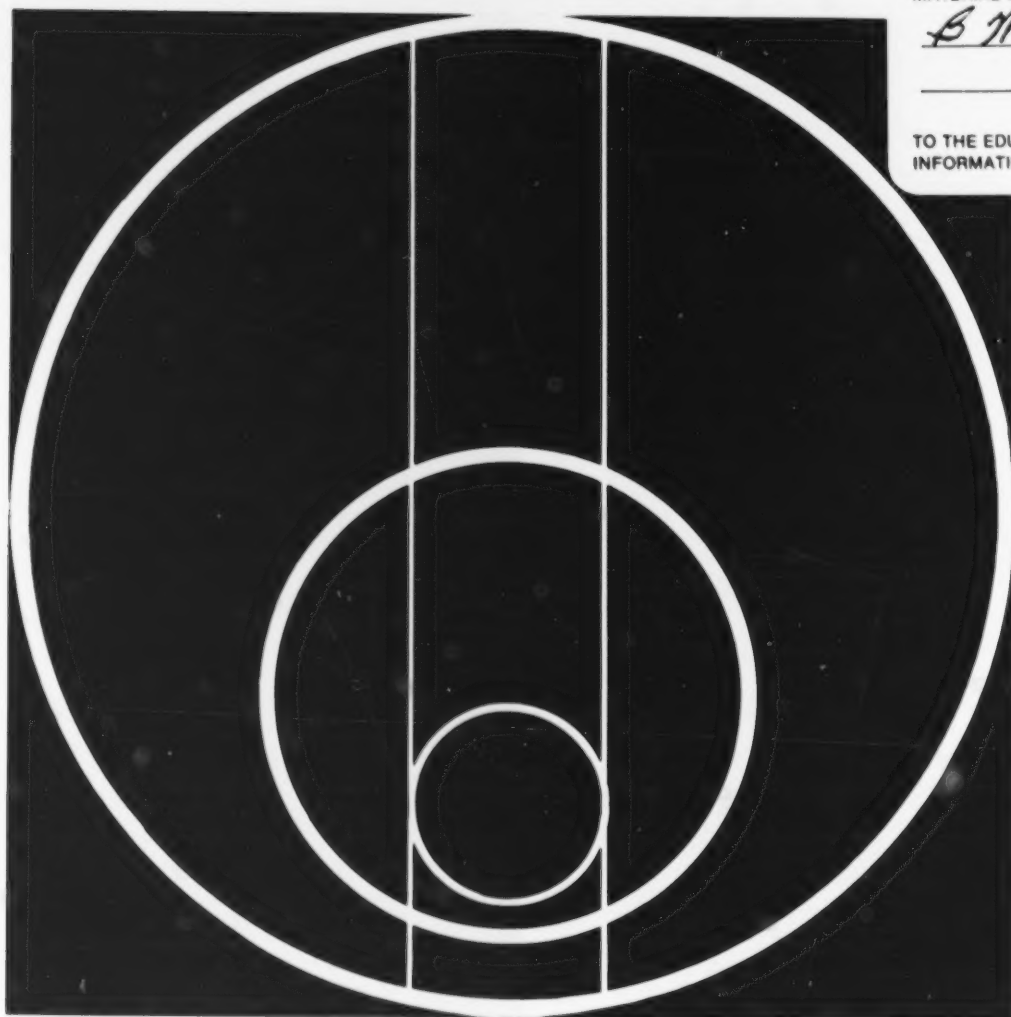
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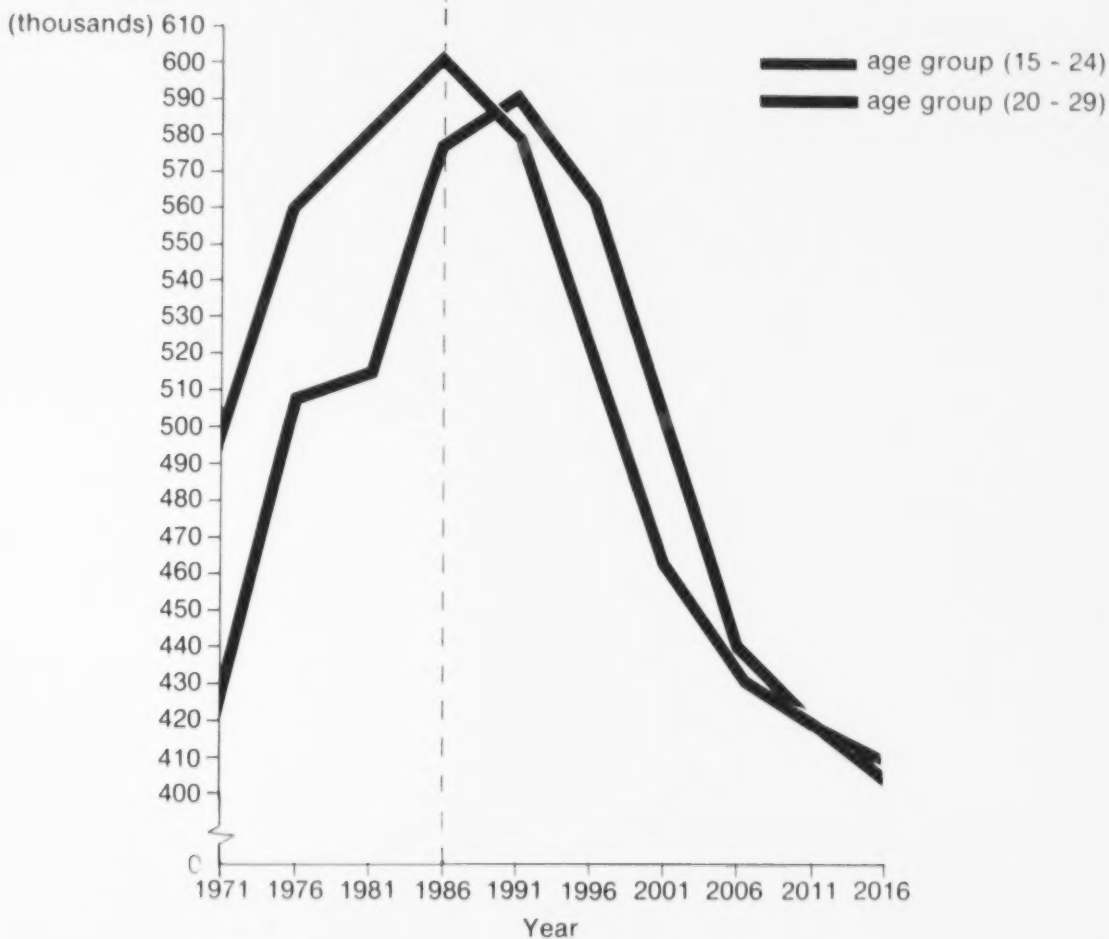
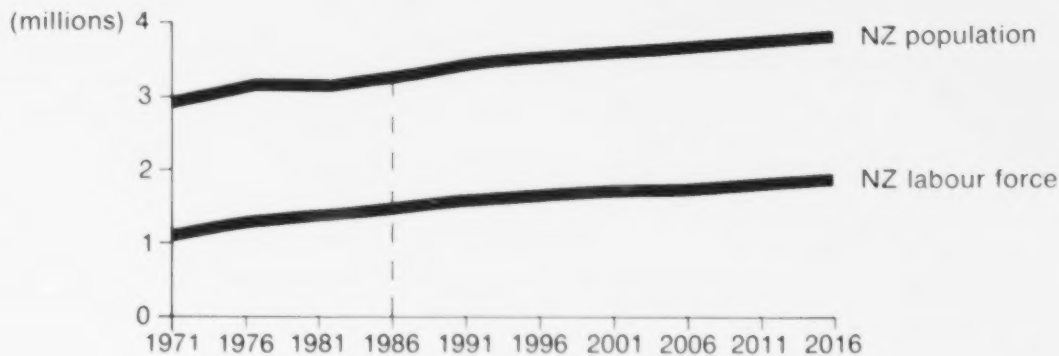
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Central Institute of Technology. Massey University
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SE 049 135

Demographic Change: 1971 - 2016
(assumptions: medium fertility and zero migration)



FOREWORD

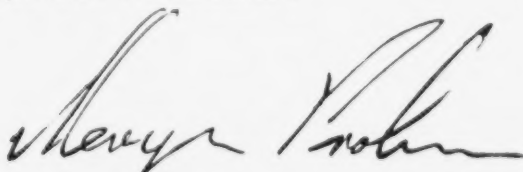
Once in a while the results of a research study are published and, because of the excellence of the study's design and the clarity of its presentation, people are suddenly alerted to an actual, or potential, social problem in a way that substantially influences the thinking of the community or, at least, an influential section of it. I believe that the first Certech report on "The Supply of Technological Skills to a Changing Economy" was just such a study.

The first report has been widely read by politicians, bankers and the business community, by teachers, scientists and technologists; and I know from personal correspondence that people have been greatly disturbed, even shocked, by the threat to our technological competitiveness if we cannot reverse the deterioration in the quantity and quality of the skilled people we produce.

I therefore welcome this second report which extends the earlier analysis and presents new insights into trends taking place in the education of our young people in an area that is vital to our future economic development. The proportion of Form 3 students who gain a tertiary qualification in science and technology is low and is predicted to decrease. As the total population in the student age group is predicted to decrease towards the year 2000, then the number of scientists and technologists in New Zealand will decrease markedly. If we believe that science and technology is one of the key threads with which we weave the cloth of the future, then these trends are significant for the future of New Zealand.

In the foregoing I have put particular emphasis on the implications of this study for science and technology. A careful examination of the data in this second report, however, reveals that the proportion of young people studying languages, the performing and creative arts, and human studies is very low. The future health of our community depends not only on the number of scientists and technologists that we train but also on the number of people of high ability who can contribute in other areas of our national life. We therefore have to be just as concerned about the fact that we have one of the lowest participation rates in tertiary education amongst the OECD nations, as we are concerned about the proportion of students taking, say, a set of subjects that fit them for a career in science and technology.

I congratulate Mr Ted Tarrant, Mr Don Griffin, Principal of the Central Institute of Technology, and the Certech Unit at Massey University, in particular the project leader Mr Barry Walsh, on the excellence of this further study, and I express the hope that it will inform, and influence, the development of new policies in education.



Dr. Mervyn Probine CB
(Hon) Director
New Zealand Technology Advancement Trust

1	2	3	4
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Subject areas

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Maths - science (m-s)

subject combinations

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UE: those students from Form 6 presenting four or more subjects for the University Entrance examination 1979-1985

BS: those students from Form 7 presenting three or more subjects for the Bursary/Scholarship examination 1979-1986

Cohort flow refers to that group of students who entered F3 together and who continue on through the education system. The group will get smaller in size as students leave at various points in the secondary - tertiary flow.

INTRODUCTION

"If we could first know where we are, and whither we are tending, we could better judge what to do, and how to do it." Abraham Lincoln.

New Zealand is finding itself suddenly thrust into the international economy. New skills are being rapidly called for and shortages in the older skills are being more acutely felt than ever before.

We can no longer survive, let alone prosper, as an exporter of crudely processed pastoral and forest products. Neither can we compete as a mass producer. We can however sell our ingenuity and skills - if the skills are there in sufficient quantity and quality. But they are not. There is also an outward flight of skills to Australia, particularly in technology.

Of every 100 third Formers in 1982, 54 reached Form 6 in 1985, 20 reached Form 7 in 1986 and it is expected that no more than 25 will gain a tertiary qualification in 1990, 9 of which will be in technology.

Furthermore, the Form 3 cohort is expected to decrease by 21% between 1982 and 1995.

- "The major factor in the rise of resource - poor nations has been the proportion of export earnings directly attributable to intellectual input: invention, research and development, product innovation, design, patents, royalties and copyright."

- "More than 60% of the annual export earnings of Japan, France, Sweden, the Netherlands and Italy depend on "brain - based" industries, while New Zealand's figure and that of Australia is less than 5%."

(Certechn: "The Supply of Technological Skills to a Changing Economy." 1986 p.9)

This document traces the student flow from Form 3 and concentrates on the characteristics of the flow from UE to BS to tertiary input and output. In following the flow, the document

- ☒ • begins with data on NZ population trends which will influence secondary and tertiary education
- ☒ • illustrates the marked drop - off from Form 3 to UE to BS levels by sex and by type of school (coed or single sex)
- ☐ • shows the spread of subject choice by sex and by type of school
- ☒ • presents maths-science subject combinations by sex and by type of school
- ☐ • indicates trends in subject selection which have implications for tertiary education and employment prospects. Trends shown by sex, by type of school and by school authority
- ☐ • provides information on graduation patterns, tertiary intakes and the output of technological skills

The document aims to present facts rather than opinions based on facts. Comment has therefore been kept to a minimum.

EDITORIAL NOTE

"Ancora imparo" Michelangelo.

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The Central Institute of Technology; Massey University;
and the New Zealand Technology Advancement Trust,

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This publication aims to present to the wider community the issues and difficulties facing New Zealand in increasing the national pool of knowledge - based skills, particularly those in technology.

Such increased skills are vital if Australia and New Zealand are to achieve economic and social goals in the competitive world economy.

• This document has been prepared with the help of Mr. Eric Archer, Dr. Ted Drawneek, Dr. Mary Earle and Mr. John Hogan; fellow members of the Certech Study Group at Massey University. Dr. Earle is further thanked for the vital co-ordinating role.

• We are much indebted to Rob Macgregor Design & Artwork and staff for their splendid artwork and design.

We thank:

• the *Research and Statistics Division of the Education Department*, particularly Mr. Ron Ross and Mr. Nic Pole for their outstanding cooperation and their stimulating suggestions;

• the *University Grants Committee* and Mr. Alan Cox and Mr. Grant Wills;

• the *Authority for Advanced Vocational Awards* and Mrs. Judith Mann;

• the *New Zealand Trades Certification Board* and Mr. John Lyon.

The Certech study has its origins in earlier work done some six years ago and it has also been influenced by the STEP/SCOPE projects in Victoria.

I thank:

• Jim Bateman OBE, Len Bayliss and Pete Taylor who helped 'point the way' six years ago when the road was somewhat lonely. Their continuing interest in the present work is gratefully acknowledged.

• Doug Price who contributed so much to the earlier work and whose counsel has proved invaluable in subsequent work.

• My former STEP/SCOPE colleagues in Melbourne, particularly Richard de Lautour, Wendely Harvey, Maria Hsieh, Peter Kirby, Professor Frank Lawson, Warren Mann and John Taylor. Their project insights and contributions have benefitted the Certech work quite significantly.

• Emeritus Professor John Bennet AO and Professor John Mack, of the University of Sydney, for their continuing help since 1976.

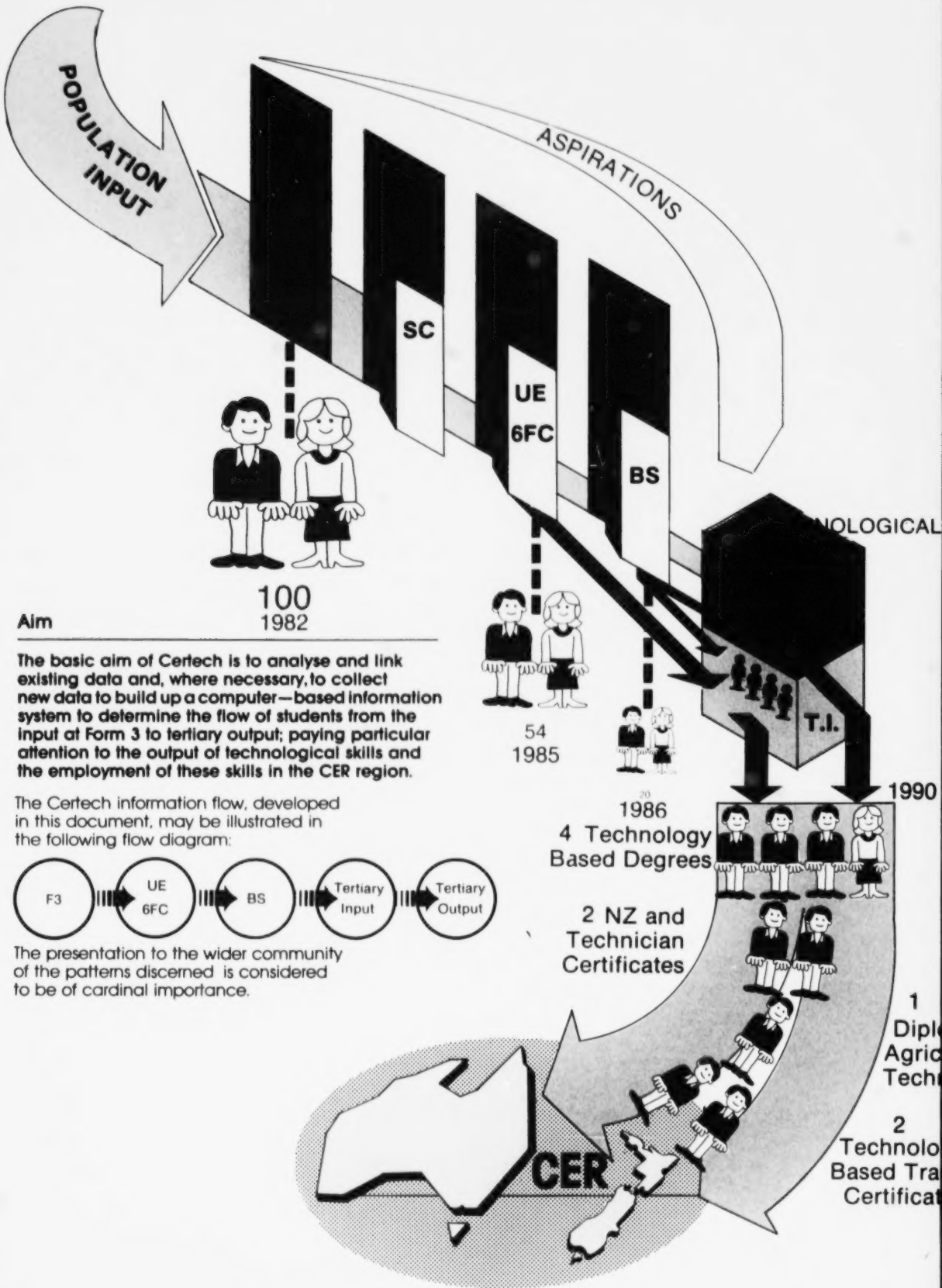
• The *International Marketing Institute* and Laurie Huggard, Ken Rankin, Gerry Mos and Valerie Reichenbach. Their continuing help, understanding and encouragement are so much appreciated.

Further information may be obtained from the Certech Study Group, Massey University.

Massey University, September 1987

Barry Walsh

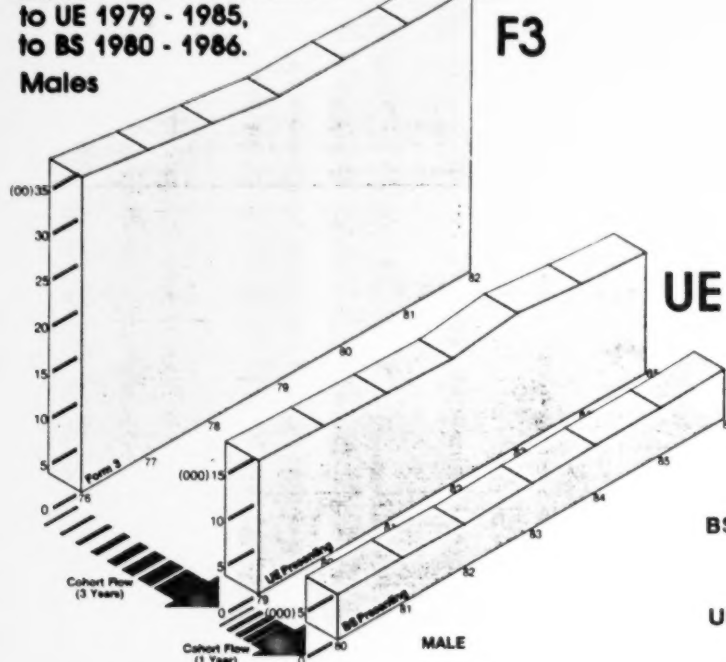
The Certech study



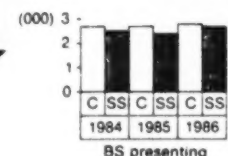
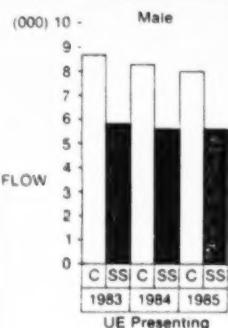
Student populations

Cohort flow from Form 3 1976 - 1982
to UE 1979 - 1985,
to BS 1980 - 1986.

Males



COHORT FLOW



BS Populations from Form 7 presenting three or more subjects for the Bursary /Scholarship examination in the period 1979 - 1986.

UE Populations (NZ) from Form 6 presenting four or more subjects for the UE examination in the period 1979 - 1985.



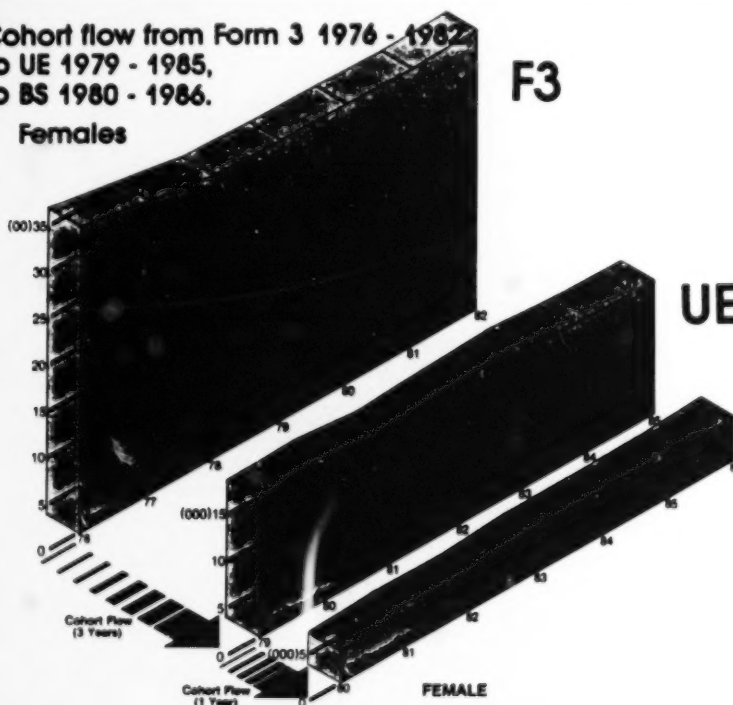
Coed

Single sex

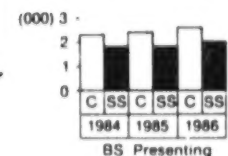
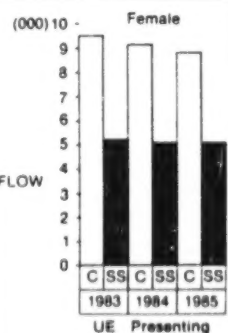
- Marked drop - off from F3 to UE and BS levels.
- Sharper decrease in coed than single sex schools at UE level.
- Single sex approaching parity with coed at BS level.

Cohort flow from Form 3 1976 - 1982
to UE 1979 - 1985,
to BS 1980 - 1986.

Females



COHORT FLOW

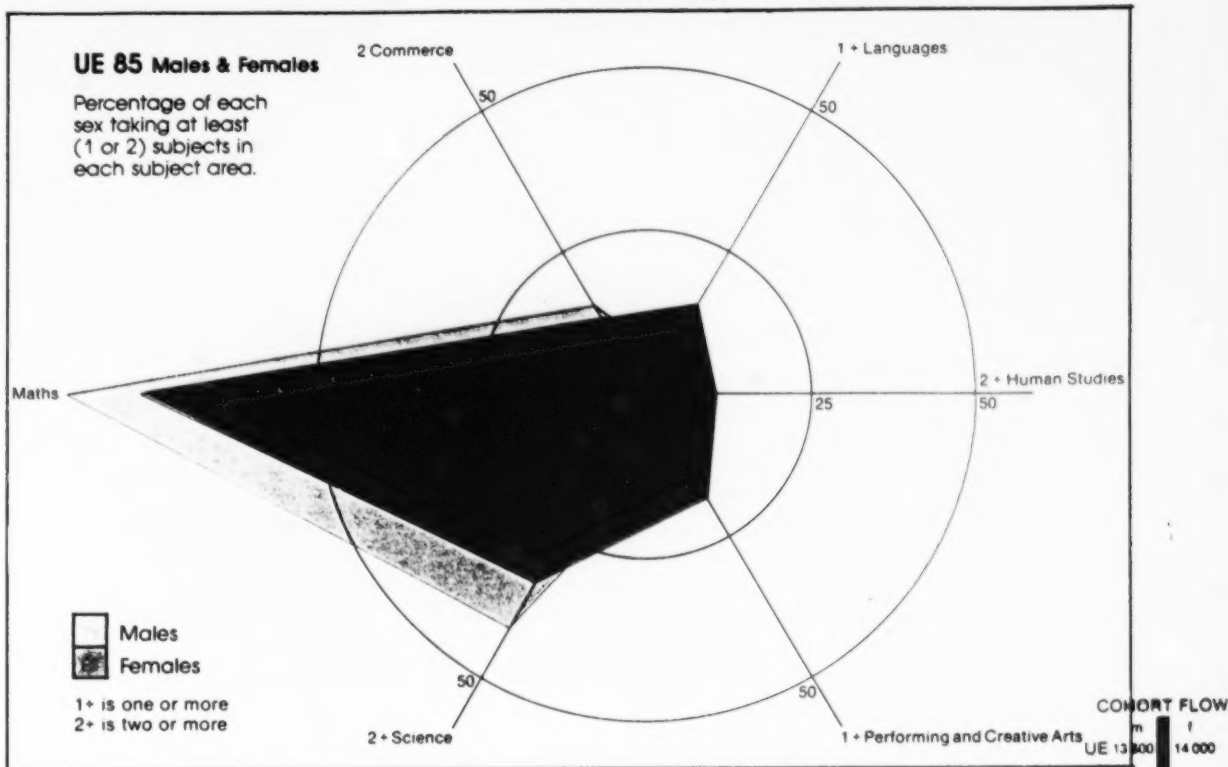


- Marked drop - off from F3 to UE and BS levels.
- Sharper decrease in coed than single sex schools at UE level.
- Coed and single sex both increasing at BS level.

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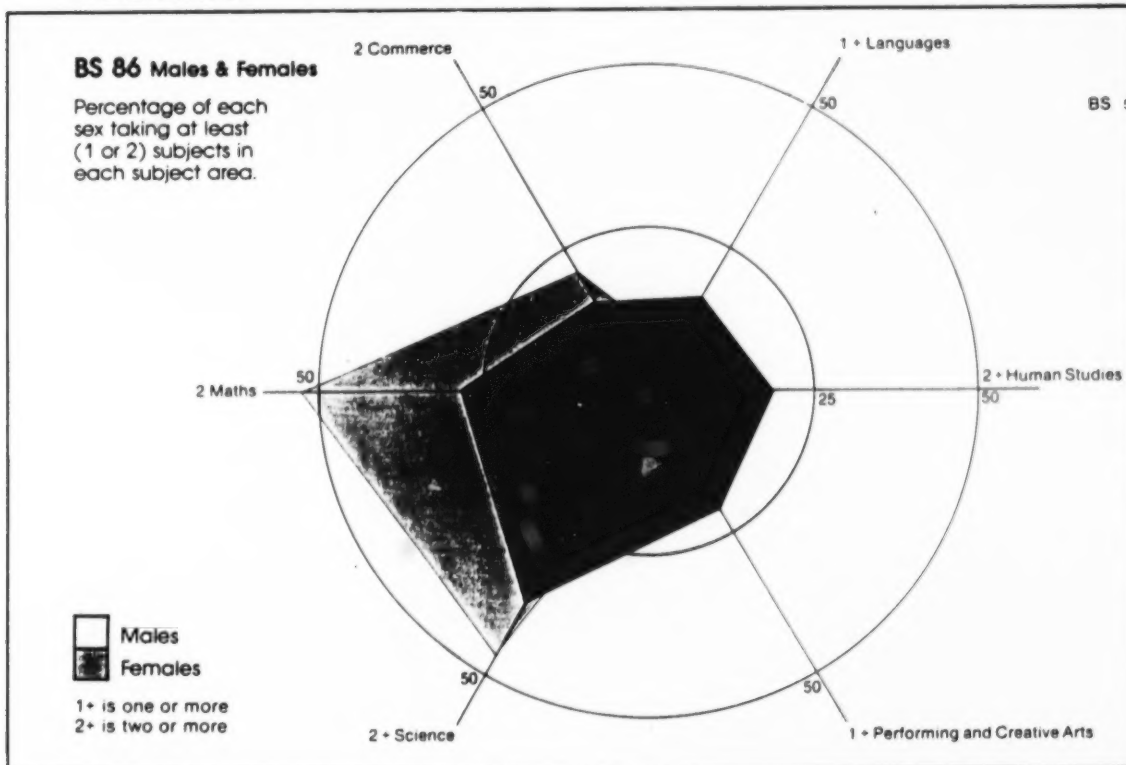
Subject areas

Commerce: accounting, economics
Human studies: classical studies, history, geography
Languages: French, German, Japanese, Latin, Maori...
Science: biology, chemistry, physics



- Patterns broadly similar
- Males more maths and science
- Females more languages and arts
- Human studies low

Note: single maths only at UE level, double maths option available at BS level.



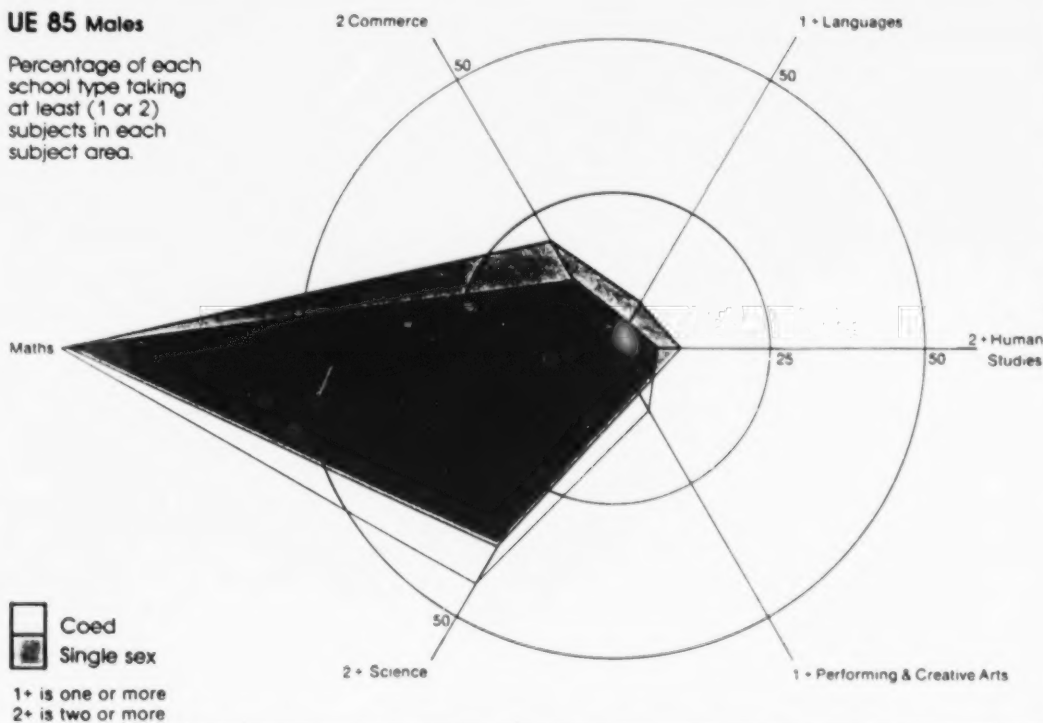
- Patterns dissimilar
- Males now much stronger in maths and commerce
- Females stronger in human studies and arts

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Subject areas

UE 85 Males

Percentage of each school type taking at least (1 or 2) subjects in each subject area.



- Patterns fairly similar.
- Coed stronger in science and arts but less in commerce and human studies than single sex.

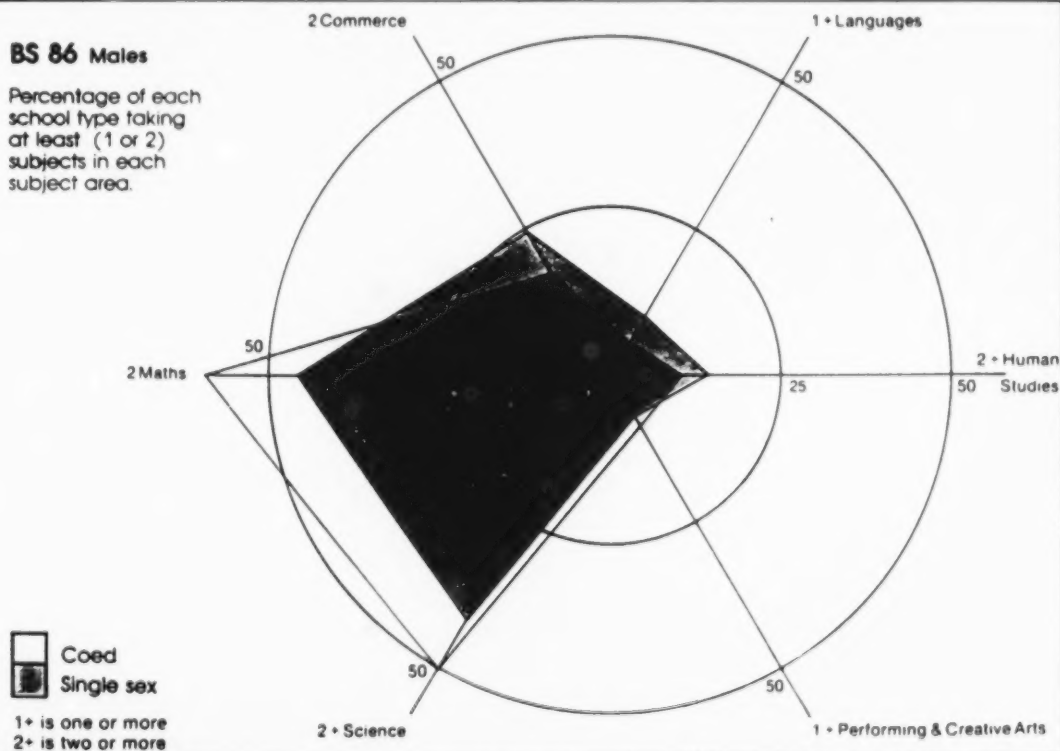
COHORT FLOW
 C S/I
 UE 8000 5600

5200 2900
 EXIT

BS 2800 2700

BS 86 Males

Percentage of each school type taking at least (1 or 2) subjects in each subject area.

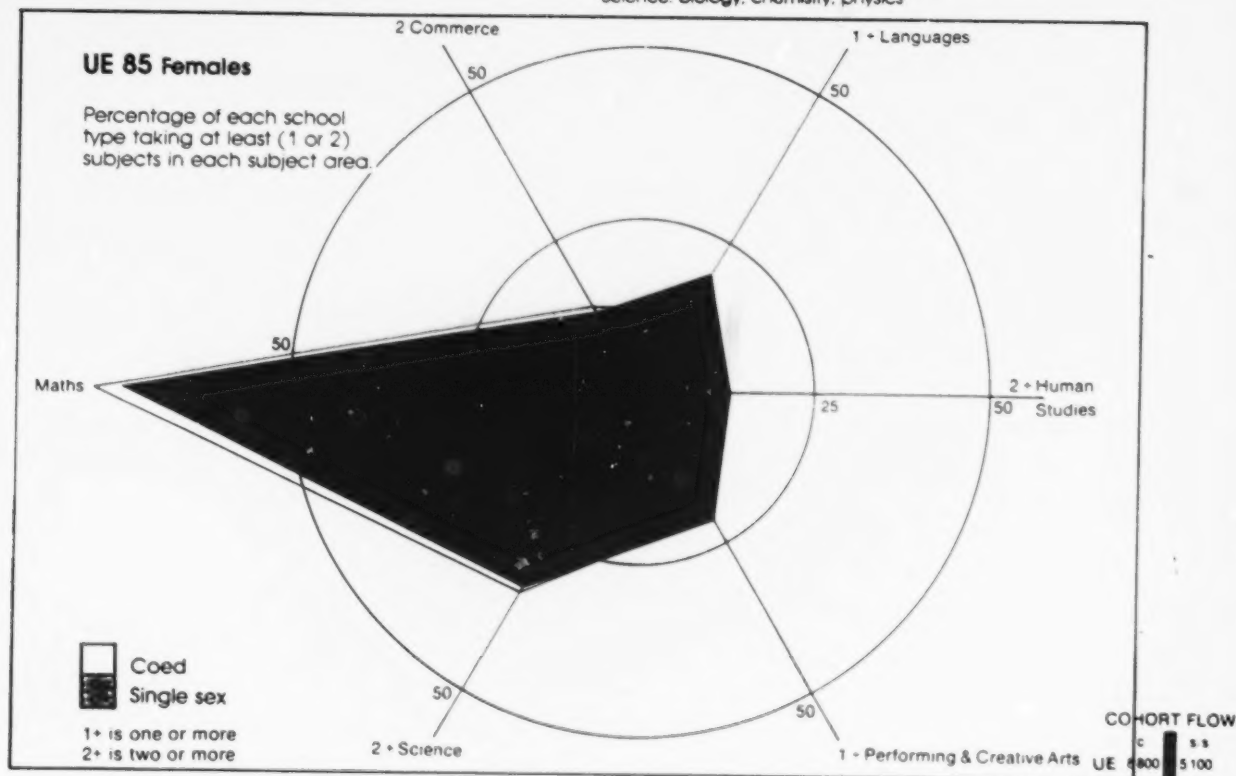


- Patterns less similar
- Coed more maths and science, single sex more human studies and commerce.

Certech

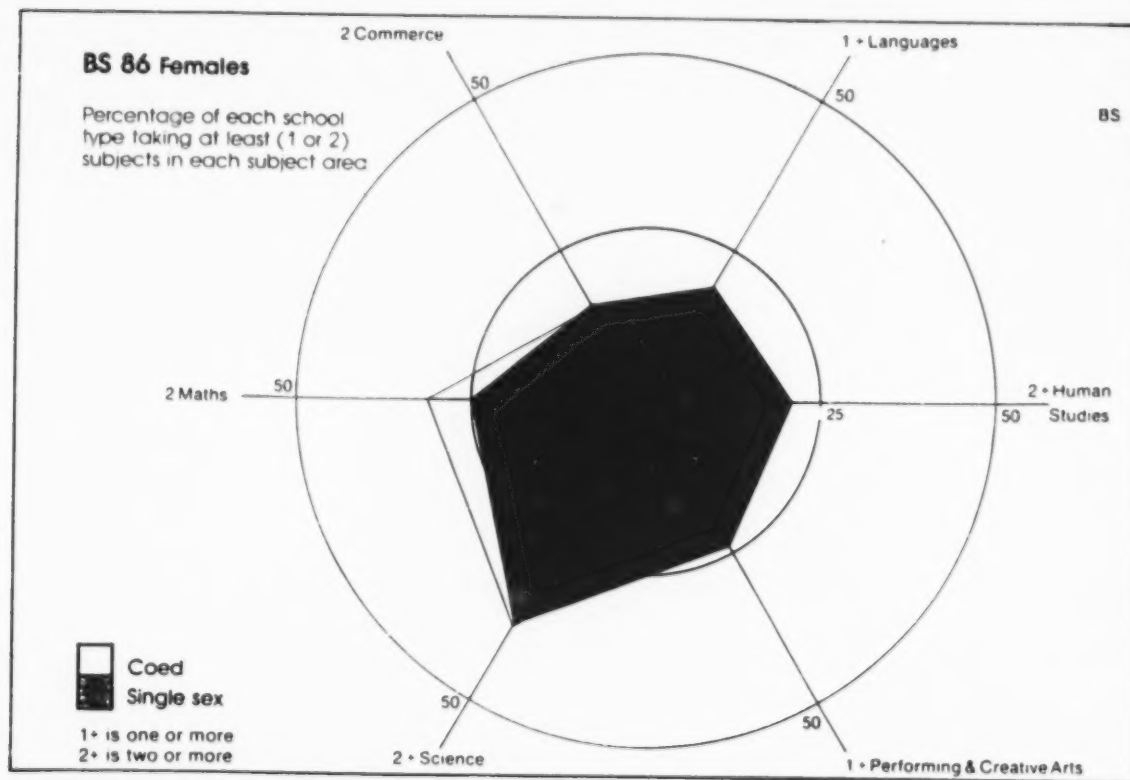
Subject areas

Commerce: accounting, economics
Human studies: classical studies, history, geography
Languages: French, German, Japanese, Latin, Maori...
Science: biology, chemistry, physics



- Patterns similar
- Single sex more languages

Note: single maths only at UE level; double maths option available at BS level



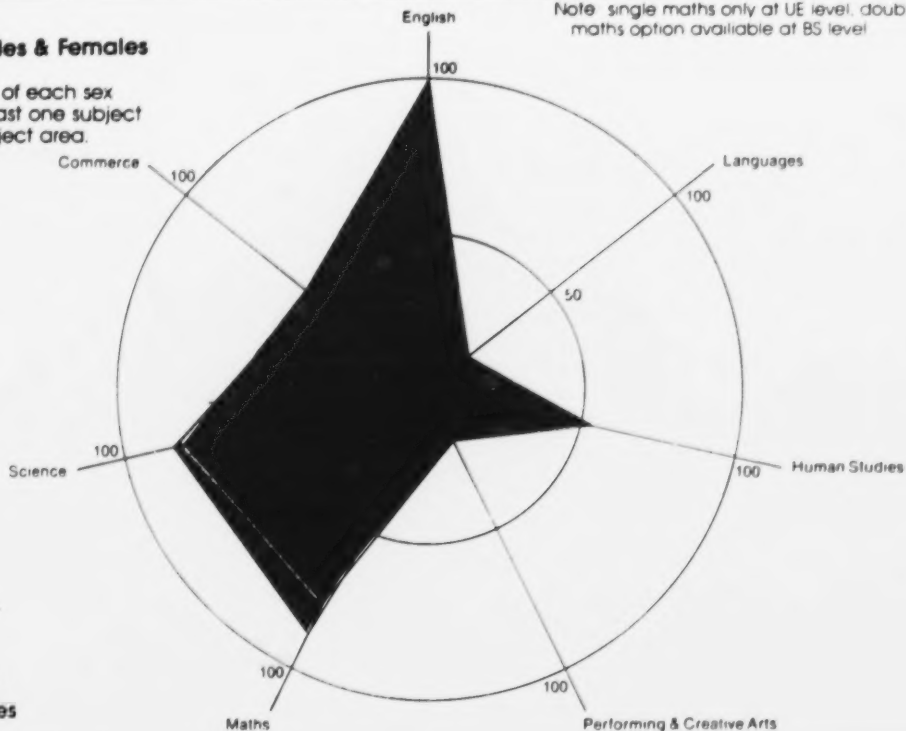
- Patterns broadly similar
- Coed more maths but less arts

Subject areas

Commerce: accounting, economics
Human studies: classical studies, history, geography
Languages: French, German, Japanese, Latin, Maori...
Science: biology, chemistry, physics

UE 85 Males & Females

Percentage of each sex taking at least one subject in each subject area.



- Patterns similar.
- General emphasis on maths, science and English for both sexes.
- Human studies and languages low.

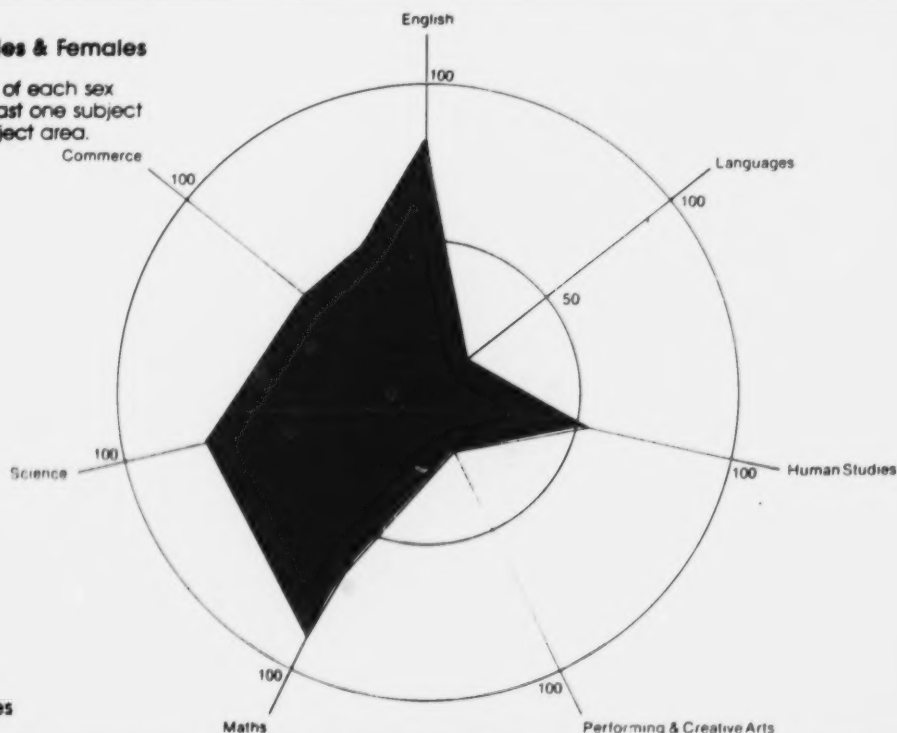
COHORT FLOW
m f
UE 13 800 14 000

8 200 9 400
EXIT

BS 5 400 4 800

BS 86 Males & Females

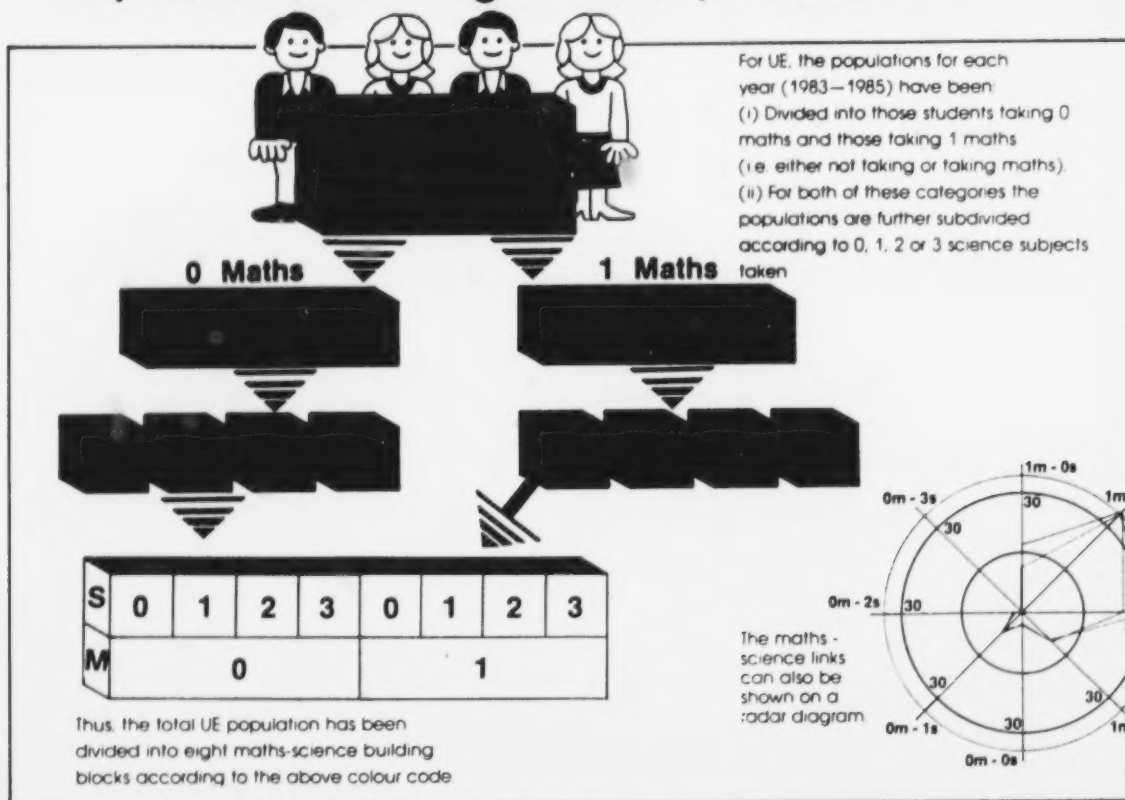
Percentage of each sex taking at least one subject in each subject area.



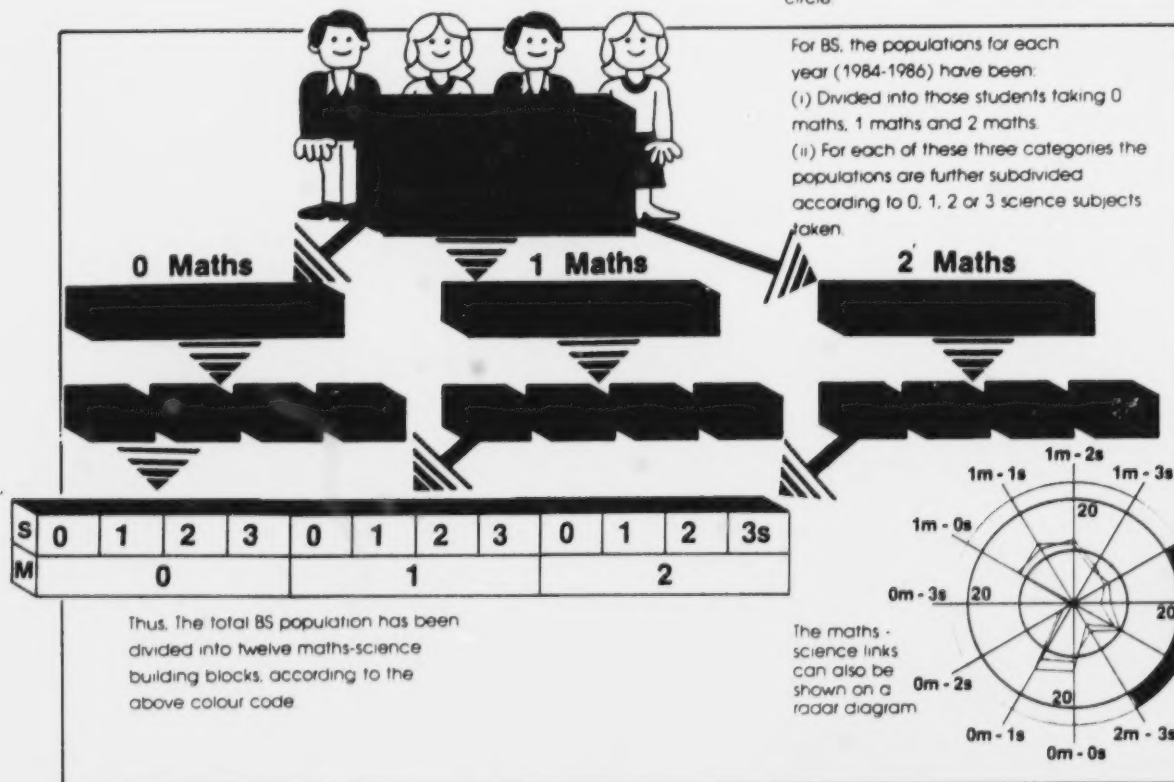
- Patterns broadly similar.
- Males stronger in maths and commerce.
- Note drop in English for both sexes.

Certech

Explanation of diagrams for pink section.



In the radar diagrams, the inner circle represents, in every case, half the percentage represented on the outer circle.



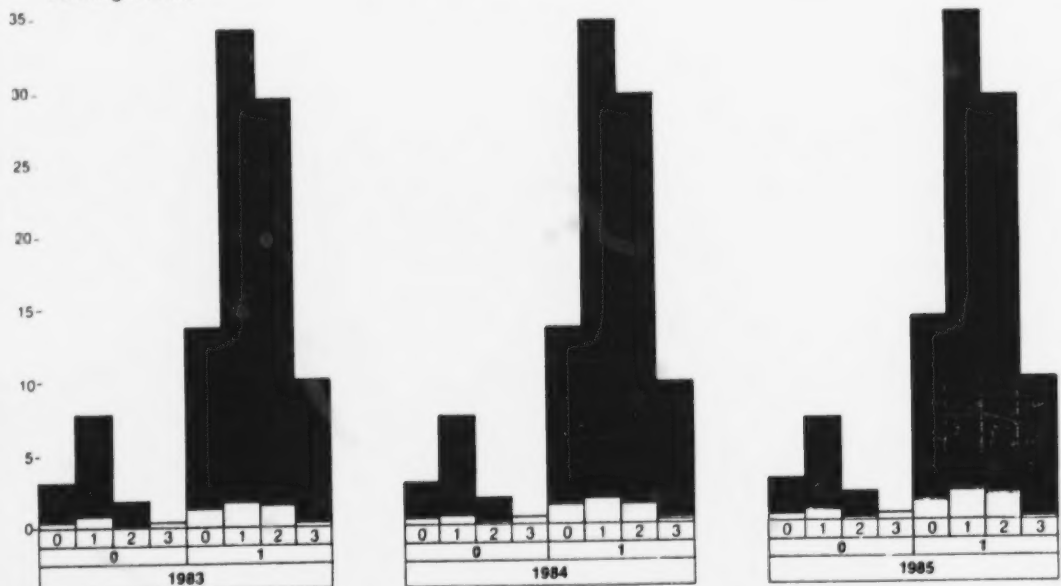
Science (s)
Maths (m)

0	1	2	3	0	1	2	3
0				1			

☐ Yellow represents language/languages in any m - s block.

UE 83 - 85 Males

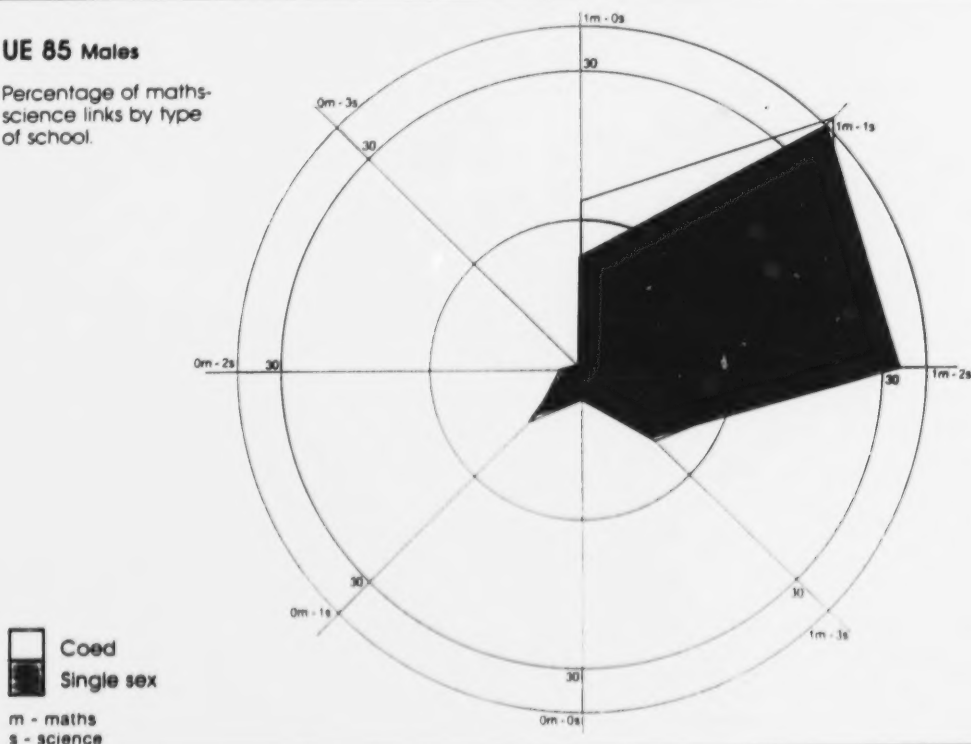
Percentage of males in the maths-science building blocks.



- Stability over the triennium with declining population (top right)
- Languages low
- Dominant combinations: 1 maths with one or two sciences

UE 85 Males

Percentage of maths-science links by type of school.



Certech

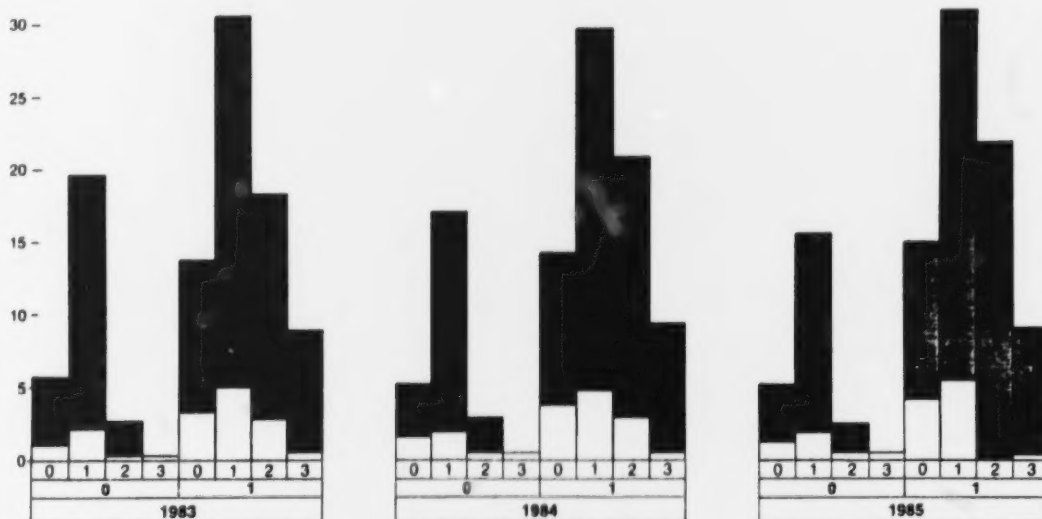
- Patterns broadly similar
- Coed stronger in 1m - 2s
- Single sex stronger in 1m - 0s

Maths—science subject combinations

UE 83 - 85 Females

Percentage of females in the maths-science building blocks.

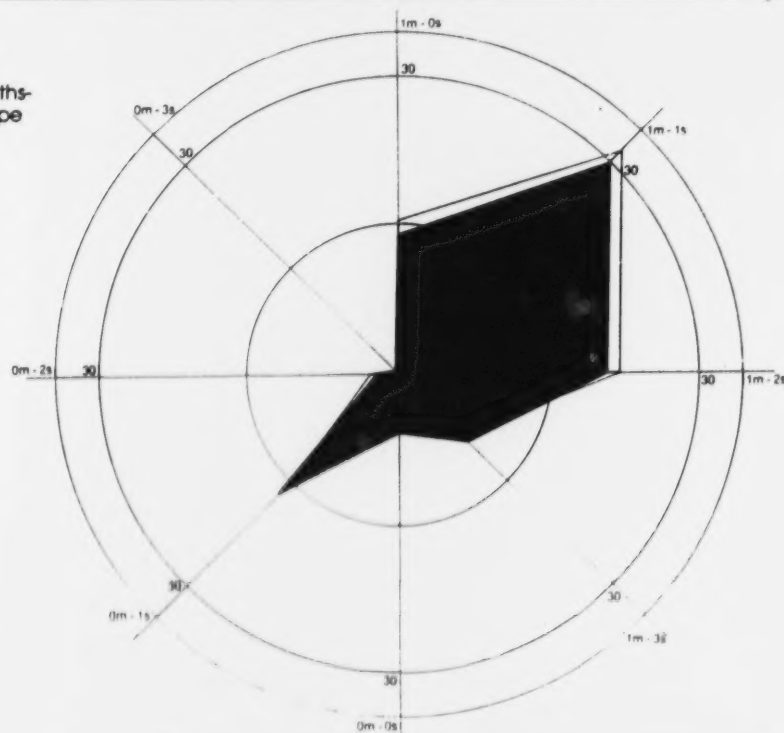
83 15 000
84
85



- Relatively stable over triennium with declining population.
- Languages higher than for males.
- Note how 1 maths with 2 sciences replaces 0 maths with 1 science as a dominant combination.

UE 85 Females

Percentage of maths-science links by type of school.



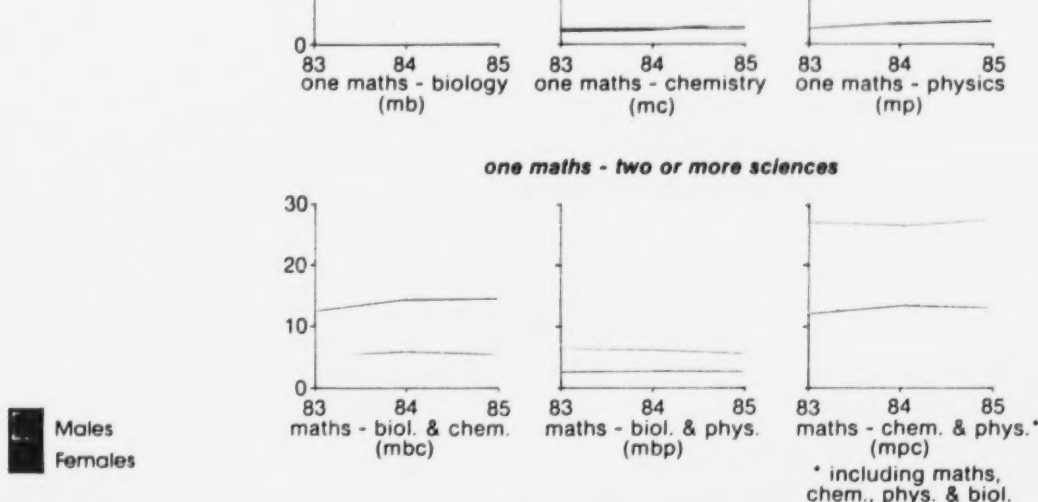
- Patterns similar
- Coed stronger generally in maths combinations

Maths—science subject combinations

UE 83 - 85

Males & Females

Percentage composition of maths-science building blocks by sex.



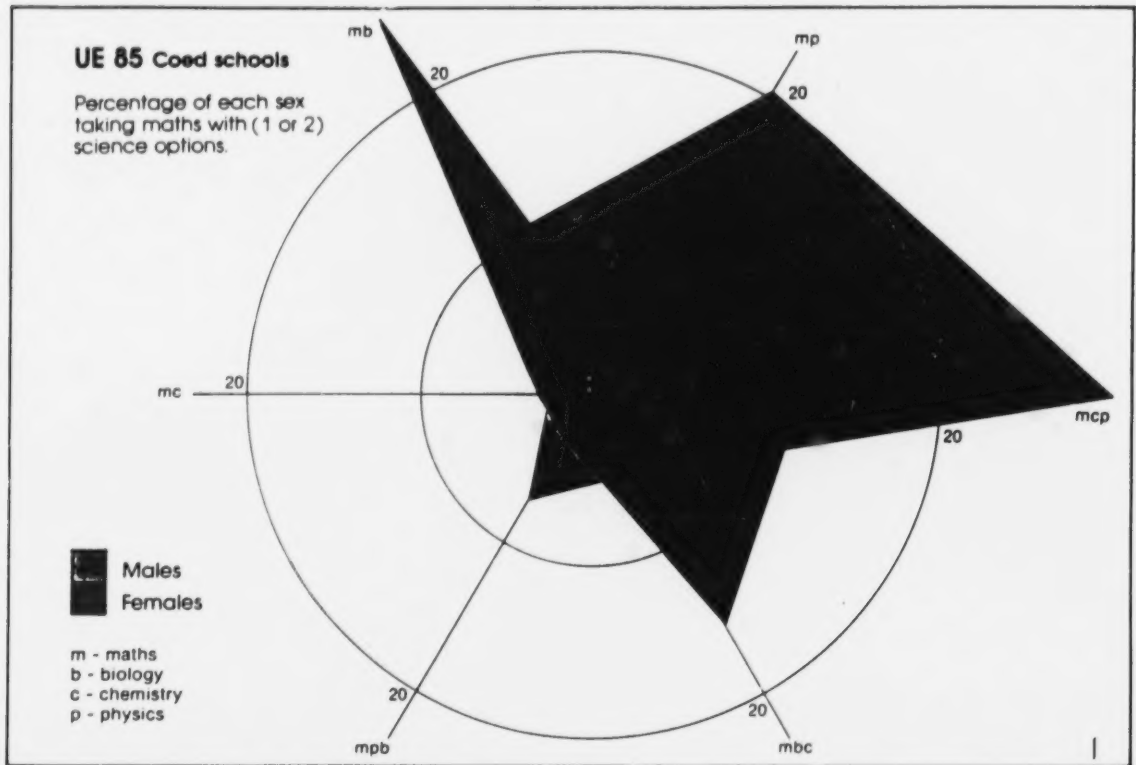
- Males dominant in physics combinations.
- Females dominant in biology combinations.
- Note how physics is increasing for males in the one-science combinations.

Analysis of Sixth Form Certificate (6FC) data — urgently needed.

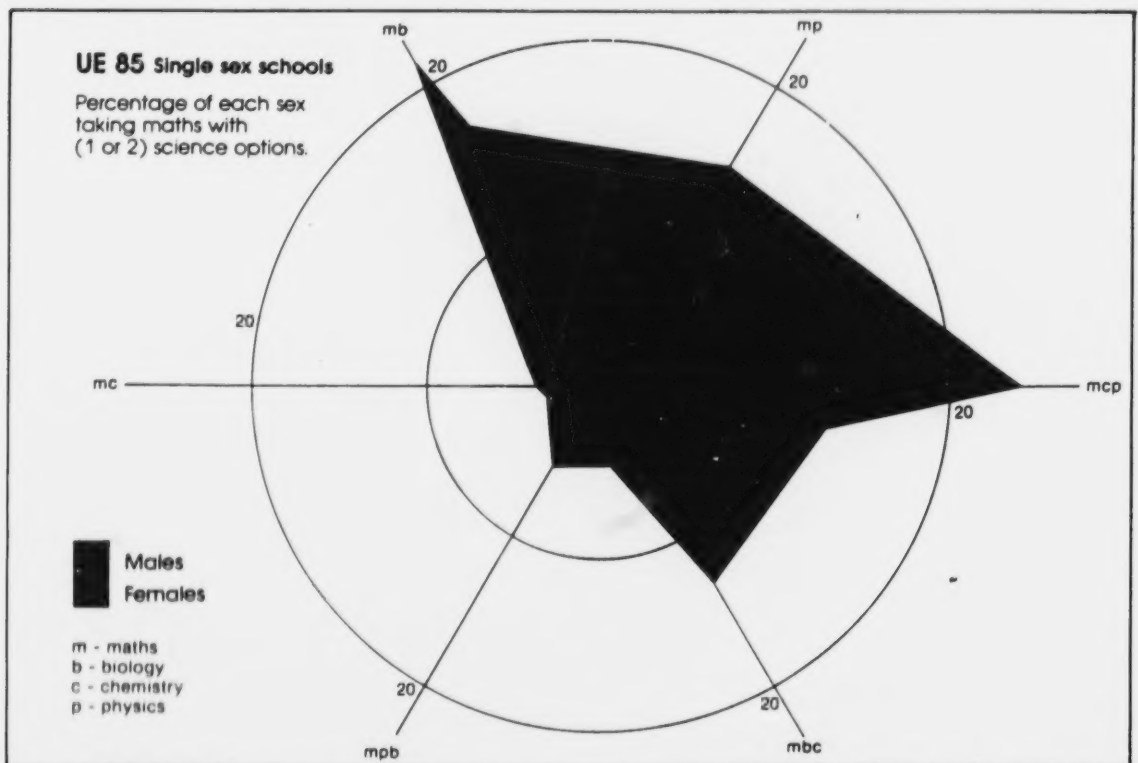


- As the UE examination was phased out in 1985, it is most important that 6FC data be analysed, annually, in such a way that the Certech flow statistics can be maintained - not only to provide management and counselling information, but also to monitor the effects of policy decisions already taken.
- Furthermore, in predicting tertiary entry patterns in the technical institutes and the universities, it will be seen how important F6 subject selections are - particularly those involving maths, science and commerce.

Maths—science subject combinations



- Patterns dissimilar
- Females stronger in biology
- Males stronger in physics.



- Pattern dissimilar
- Single sex females similar to Coed females, but lower in 'mbc'
- Single sex males less than Coed males for physics combinations

Science (s)
Maths (m)

0	1	2	3	0	1	2	3	0	1	2	3
0				1				2			



Yellow represents language/languages
in any m - s block

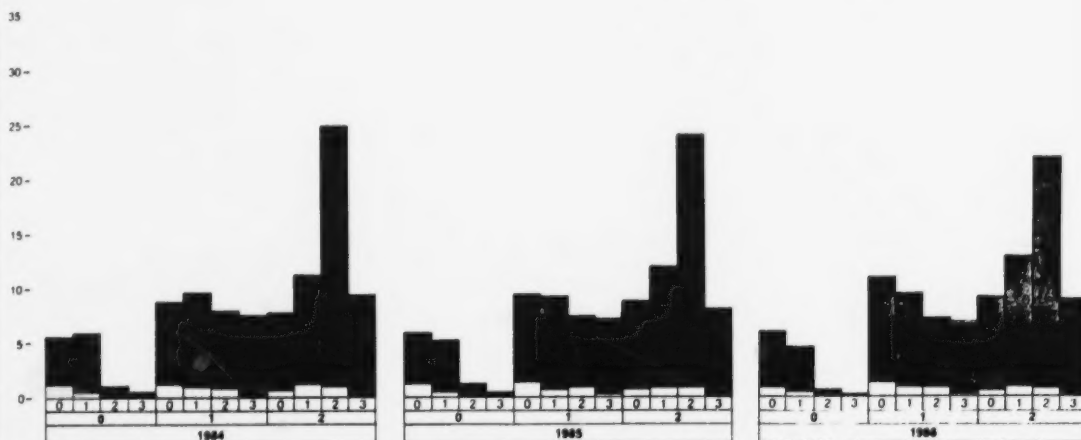
BS 84 - 86 Males

Percentage of males in
the maths-science
building blocks.

84 5 000

85

86



- Relatively stable over the triennium with significant population increase in 1986.
- 2 maths with 2 sciences dominant, but decreasing over the triennium.
- Languages low.

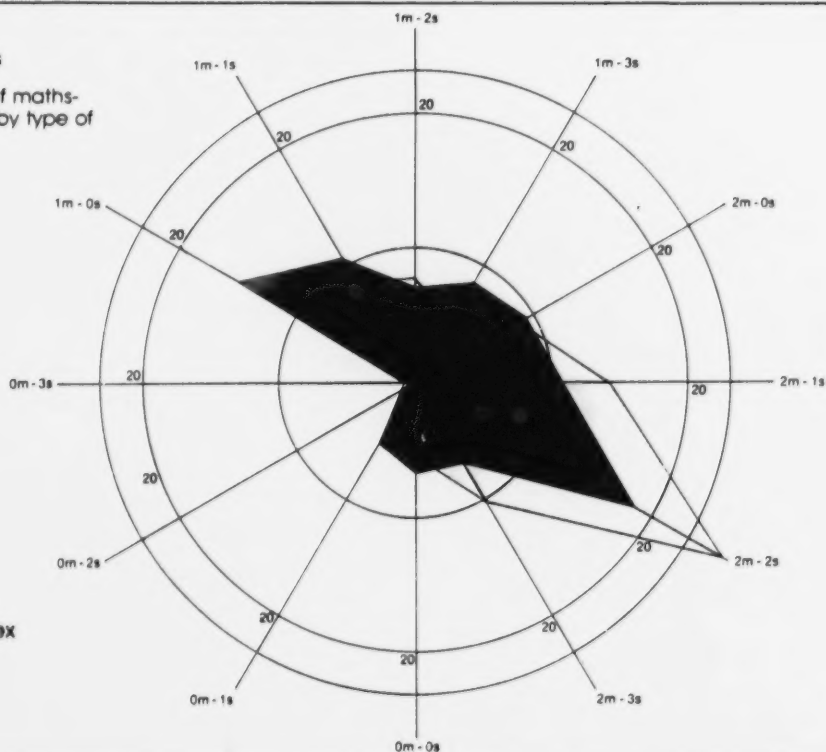
BS 86 Males

Percentage of maths-
science links by type of
school.



Coed
Single sex

m - maths
s - science



- Patterns broadly similar.
- Coed more 2 maths with science links than single sex schools.

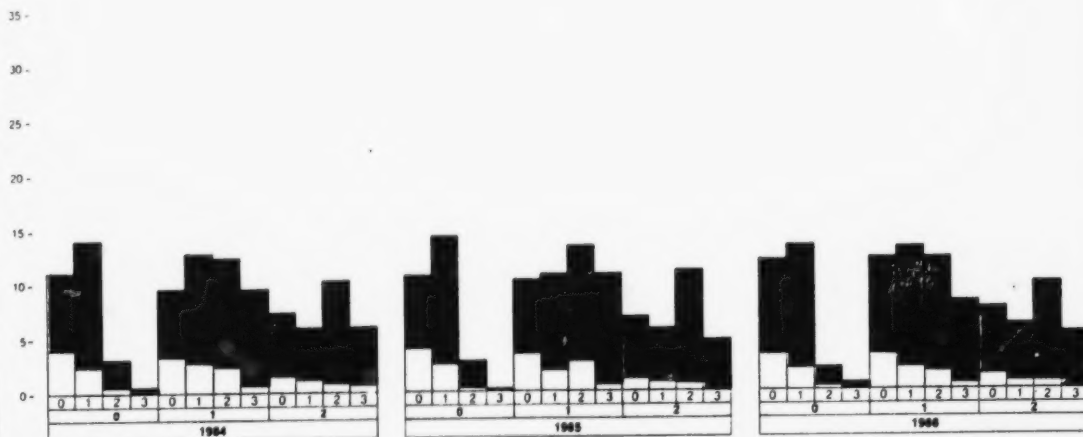
Certech

Maths—science subject combinations

BS 84 - 86 Females

Percentage of females in maths-science building blocks.

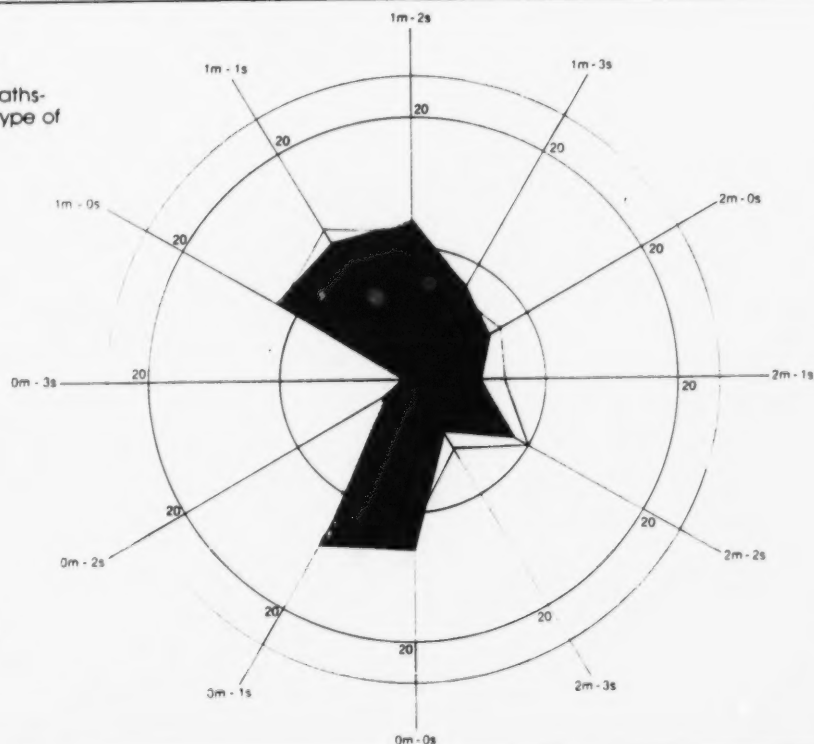
84  5000
85 
86 



- Reasonably stable over triennium with significant population increase in 1986
- Females higher in 0 maths links than males
- Languages significantly higher than for males.

BS 86 Females

Percentage of maths-science links by type of school.



- Patterns similar
- Coed and single sex females low in 2 maths and high in maths links when compared with males.

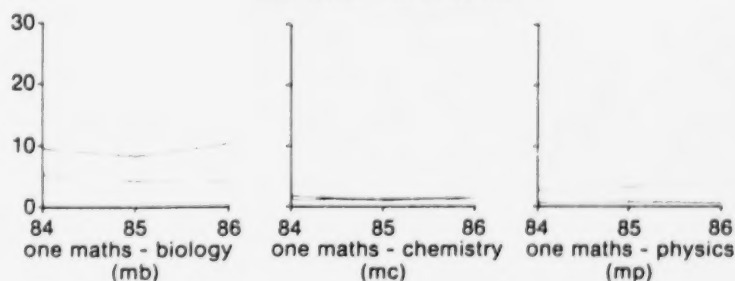
Maths—science subject combinations

BS 84 - 86

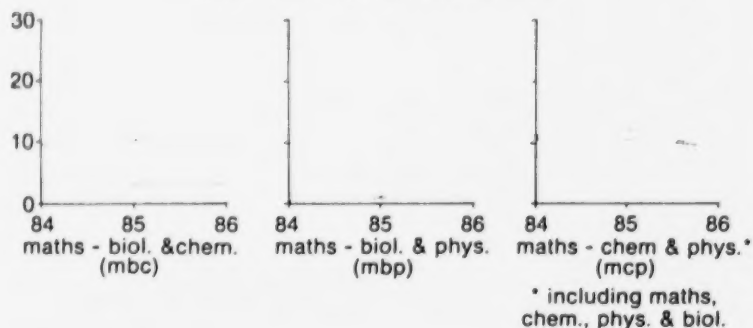
Males & Females

Percentage composition of maths - science building blocks by sex

one maths - one science



one maths - two or more sciences



 Males
 Females

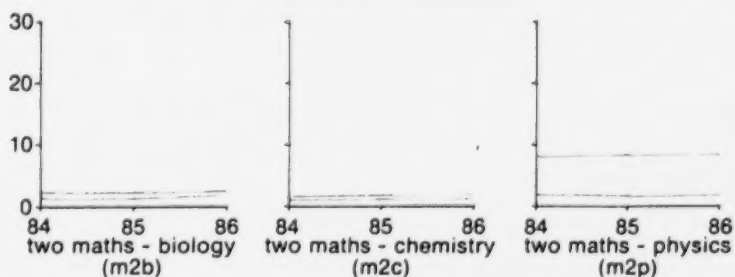
- Relatively stable over triennium
- Females stronger in biology combinations.

BS 84 -86

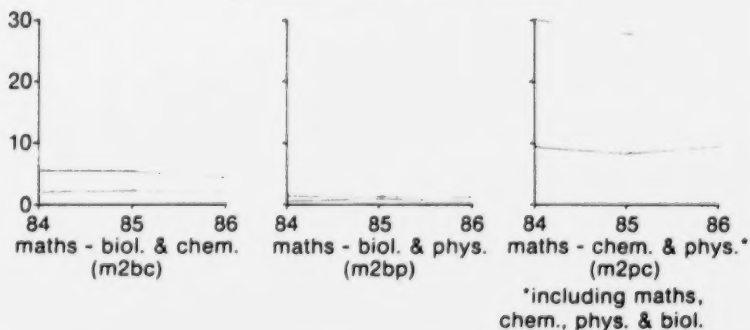
Males & Females

Percentage composition of maths - science building blocks by sex

two maths - one science

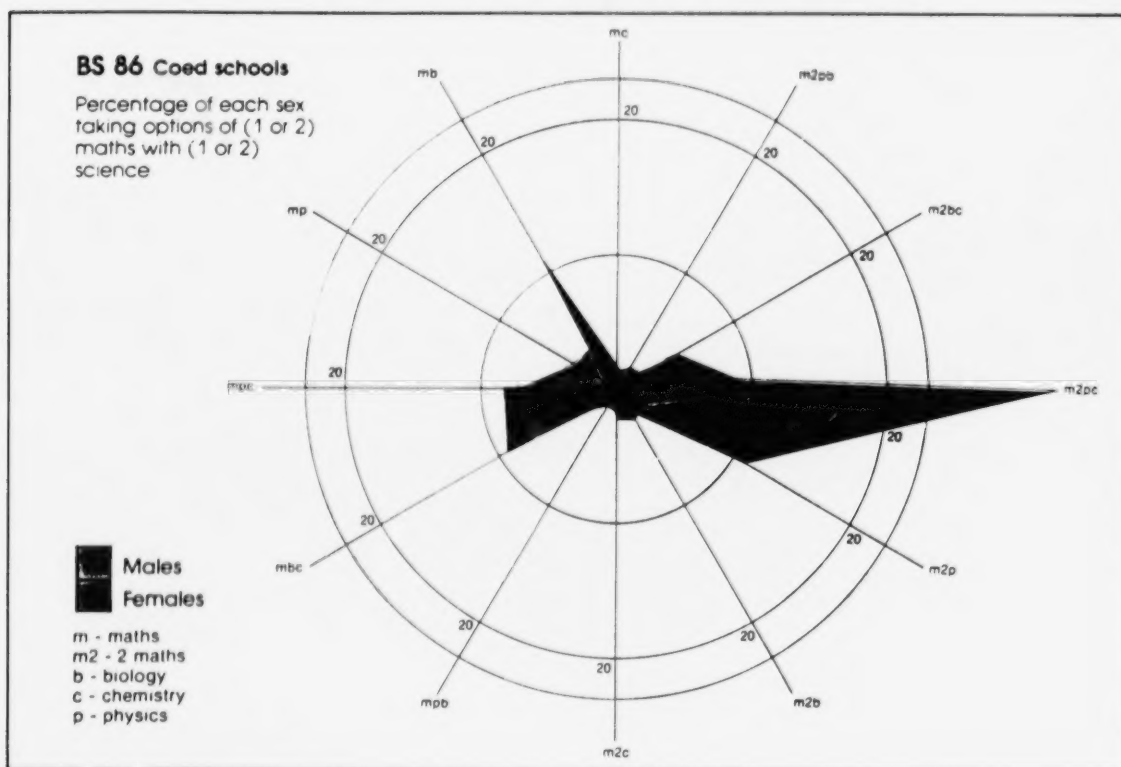


two maths - two or more sciences

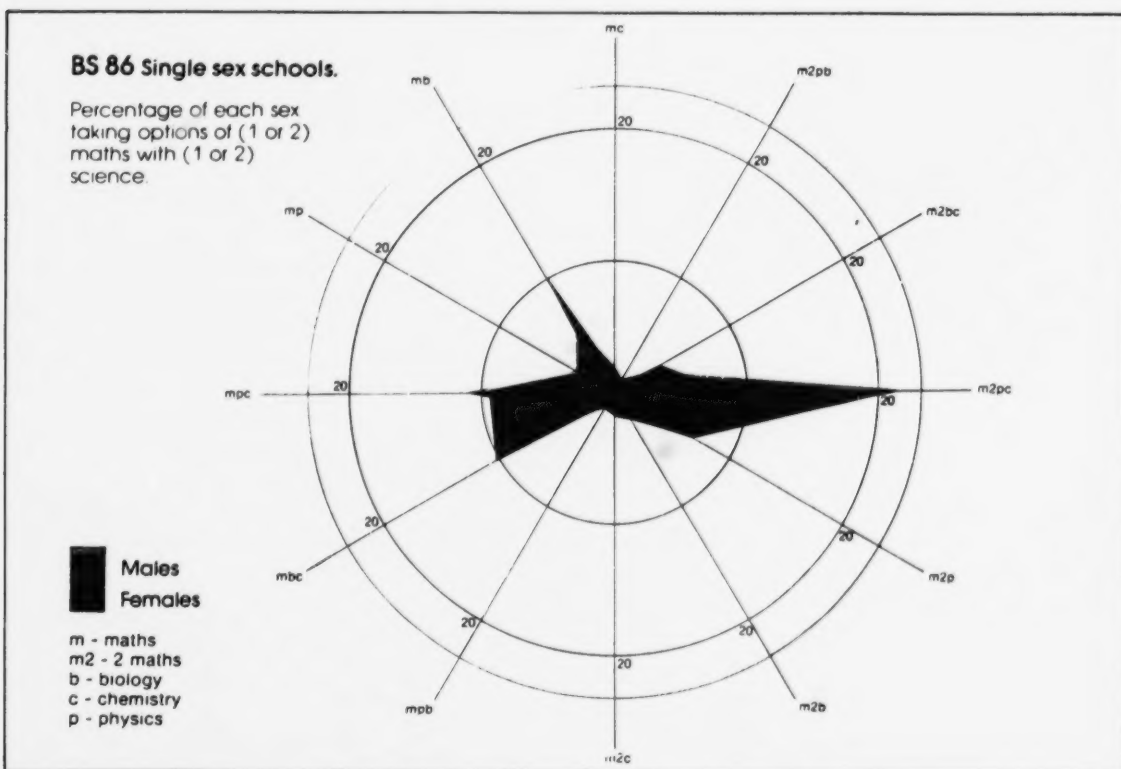


- While males dominate with 2 maths, chemistry and physics, note decrease since 1984

Maths—science subject combinations



- Patterns dissimilar
- Female preference for biology combinations over physics combinations, compared with males



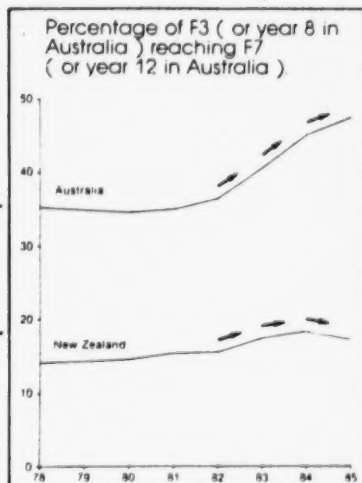
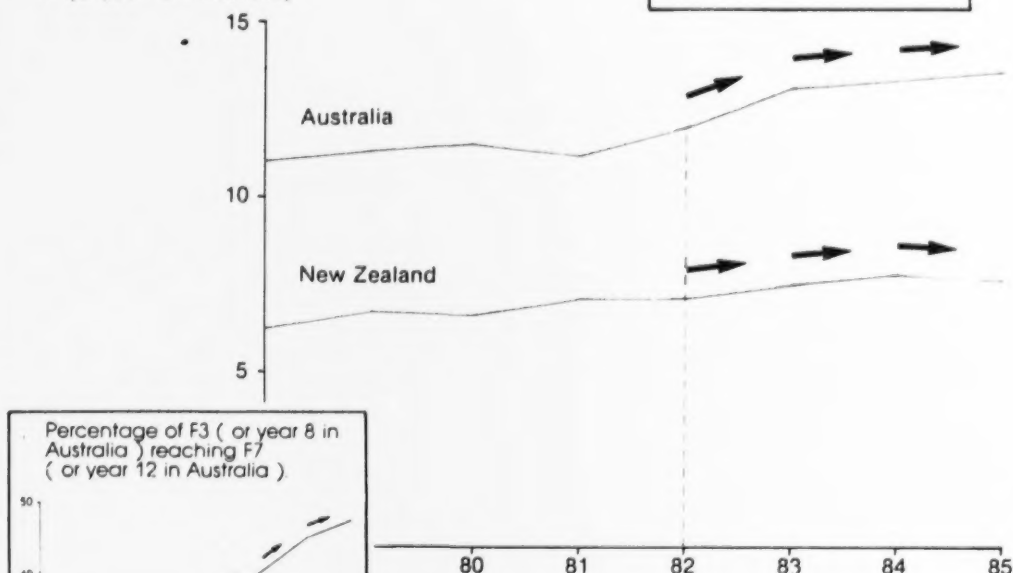
- Patterns dissimilar
- Greater difference in males between Single sex and Coed schools than females



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Curtin University of Technology,
Perth, WA.

CER comparison: Males and Females

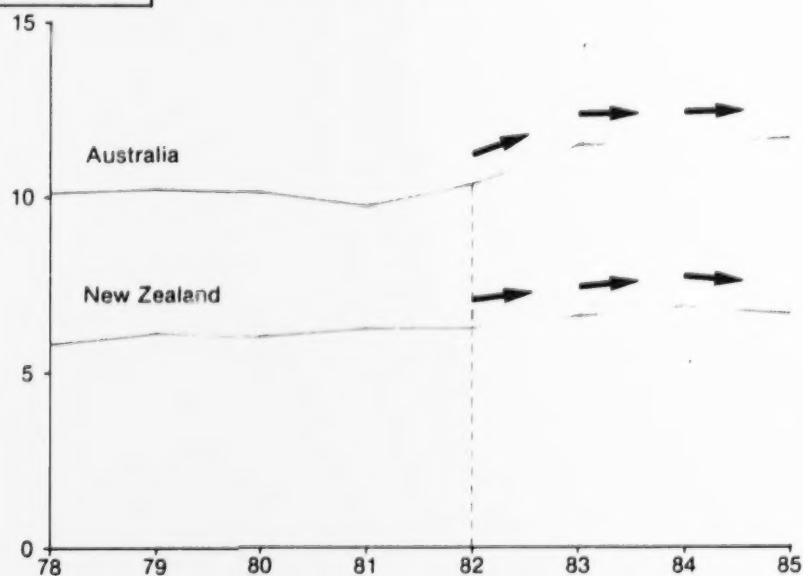
Percentage of F3 (or year 8 in
Australia) taking chemistry in
F7 (or year 12 in Australia).



- Since 1982, significant improvement in Australian retention of chemistry to year 12
- Some improvement in N.Z. retention of chemistry to F7 after 1982

CER comparison: Males and Females

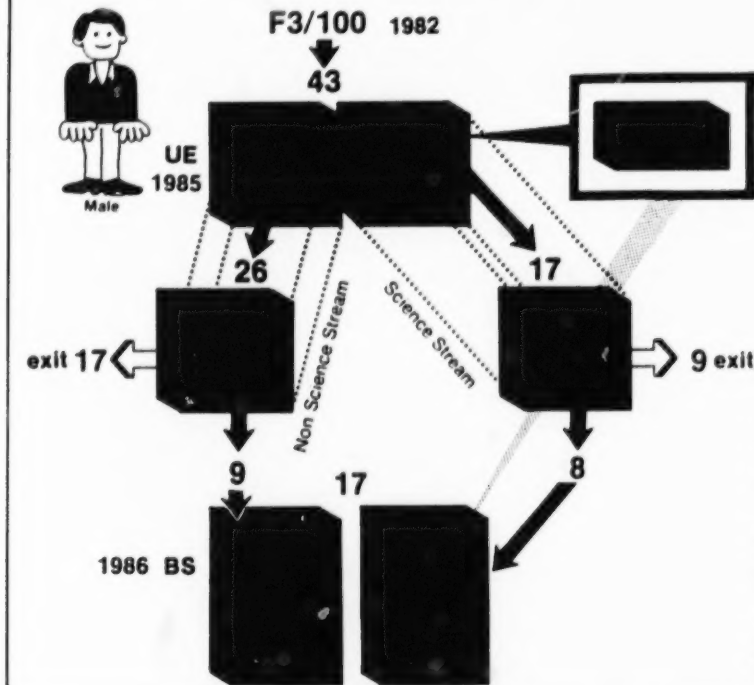
Percentage of F3 (or year 8 in
Australia) taking physics in F7
(or year 12 in Australia).



- Improvement in Australian retention of physics since 1982
- While Australia has better retention for chemistry and physics to year 12, it should be noted that Australian retention rates are not high by OECD standards.

Subject selection and tertiary options

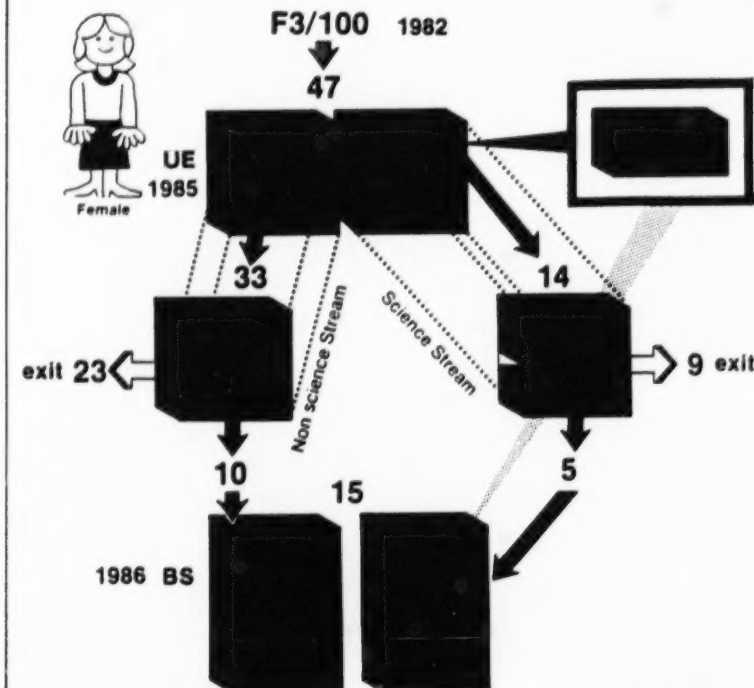
The dividing of the F3 cohort flow into science and non - science streams.



Science (s)
Maths (m)

0	1	2	3	0	1	2	3	0	1	2	3
0				1				2			

The dividing of the F3 cohort flow into science and non - science streams.



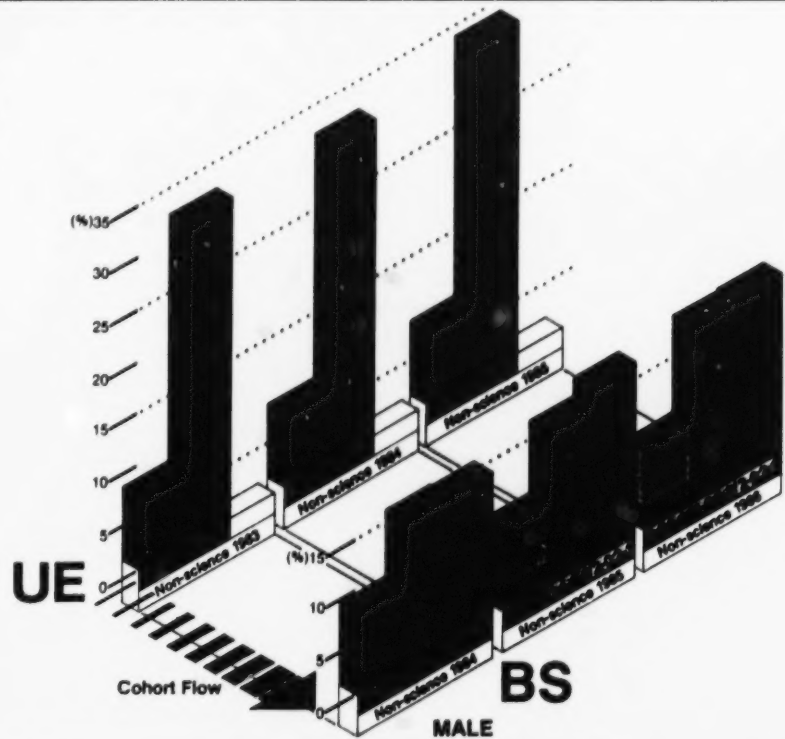
- Note the marked drop - off from F3 to UE and BS levels.
- Numbers at BS level low and particularly low in science stream for females.

Subject selection and tertiary options

UE 83-85 Males

BS 84-86 Males

Percentage of males presenting (1 or 2) commerce in non-science stream.



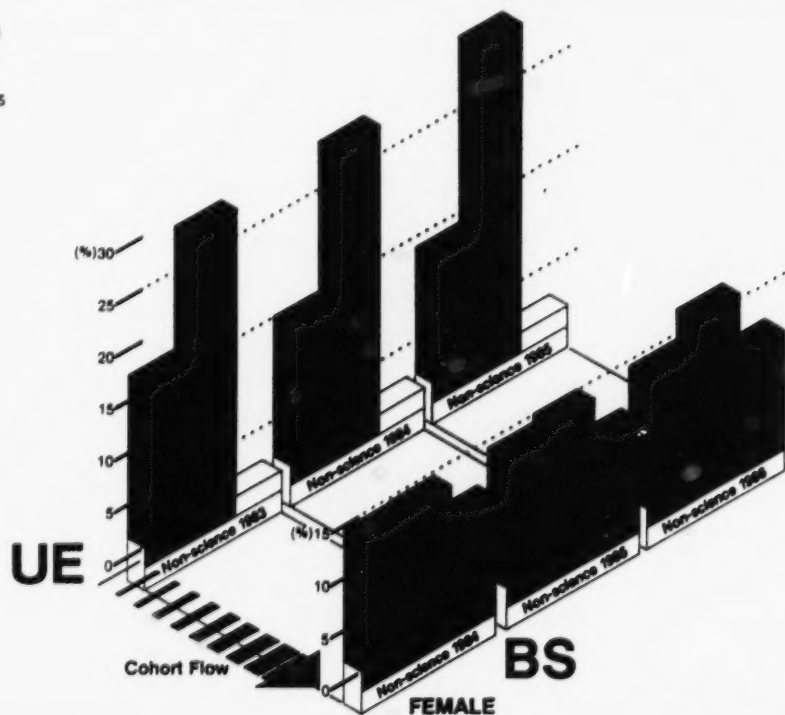
■ 2 commerce
■ 1 commerce

- Increase in commerce, particularly 2 commerce, with maths (red m-s blocks) at UE level.
- Increase in commerce, particularly 2 commerce, with maths at BS level.
- Note increasing 2 maths with two commerce (blue m-s blocks).

UE 83-85 Females

BS 84-86 Females

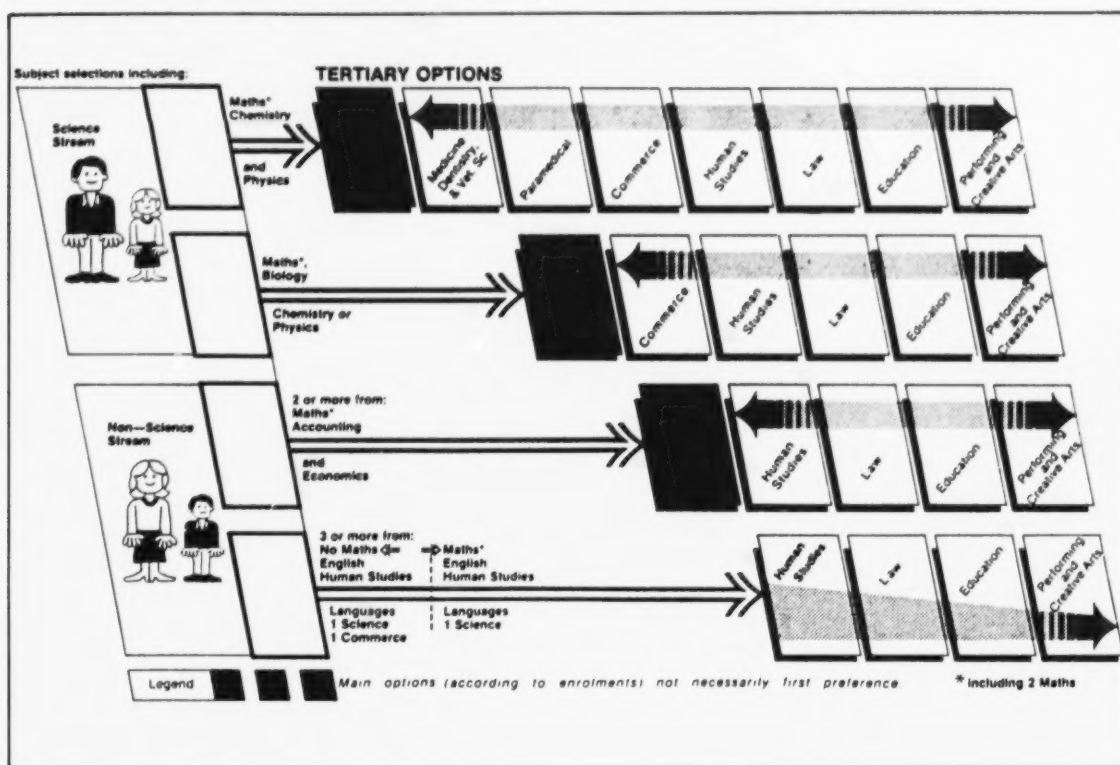
Percentage of females presenting (1 or 2) commerce in non-science stream.



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- Increase in commerce at UE level.
- Increase in commerce with maths at BS level, particularly 1 maths with 2 commerce.

Subject selection and tertiary options



Notes on tertiary options

1. Technology option includes: first degrees

- agriculture & forestry
- engineering & technology
- science
- architecture & town planning
- NZ & technician certificates**
 - engineering
 - communications
 - science (excluding paramedical option)
 - forestry
 - computer technology
 - draughting
 - building/quantity surveying
 - town planning/land surveying
- diplomas in agricultural technology**
- technology-based trade certificates**
 - avionics
 - aircraft engineering
 - electrical: appliance, HE, electrical engineering & machinery
 - heating, ventilation & airconditioning
 - industrial instrumentation
 - radio: communication, colour TV & industrial electronics
 - refrigeration

2. Commerce option includes: first degrees

- business studies
- commerce
- management studies
- agricultural commerce
- agricultural economics
- commerce (value & property management)

NZ certificates

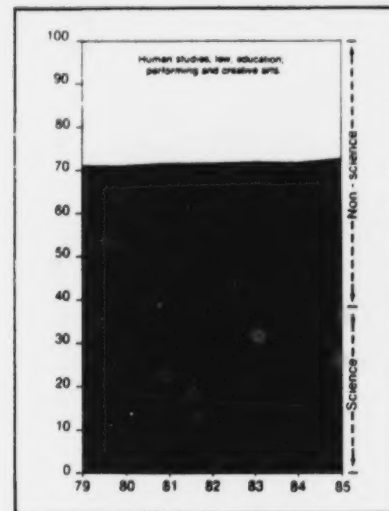
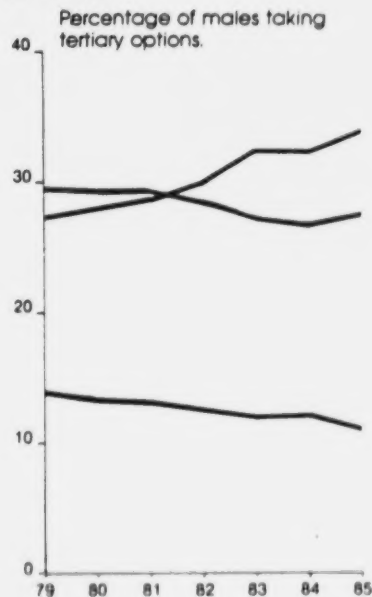
- commerce

3. Human studies option includes: first degrees

- arts
- social sciences

Subject selection and tertiary options

UE 79-85 Males



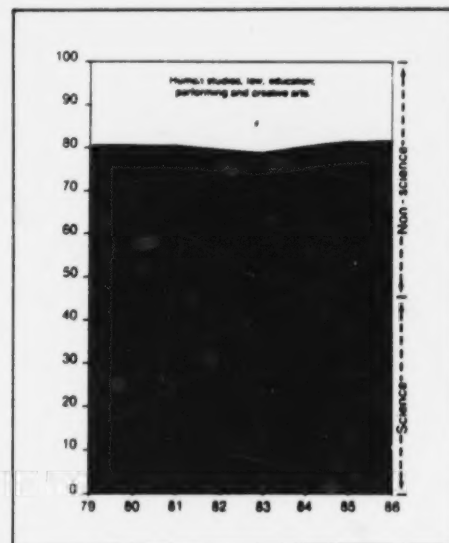
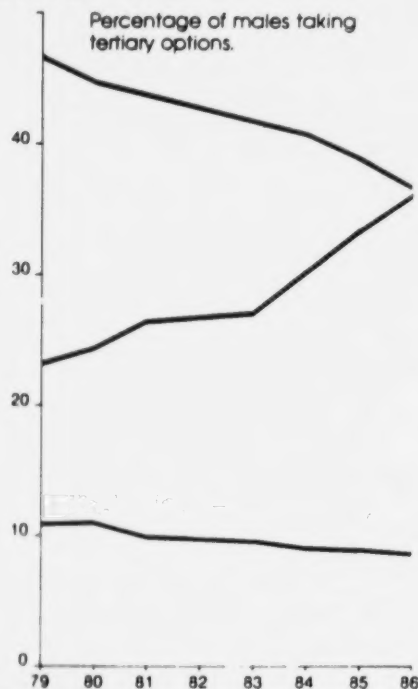
Percentage share of male tertiary options.

COHORT FLOW

commerce
paramedical
technology

• Increase in commerce, decrease in both science options.

BS 79-86 Males

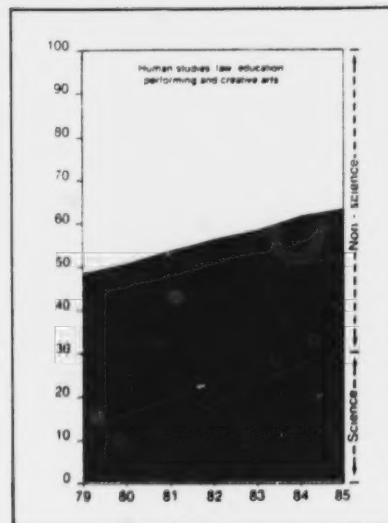
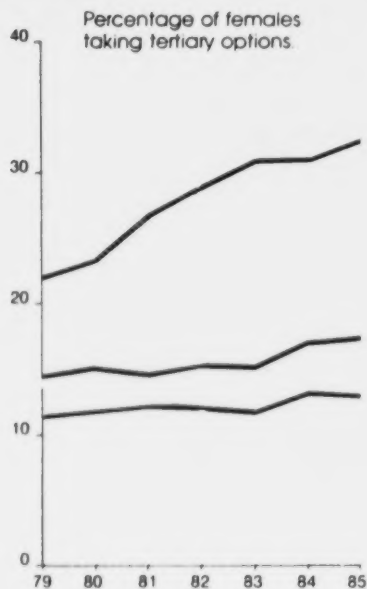


Percentage share of male tertiary options.

• Rapid increase in commerce, significant decreases in both science options.

Subject selection and tertiary options

UE 79-85 Females



Percentage share of female tertiary options.

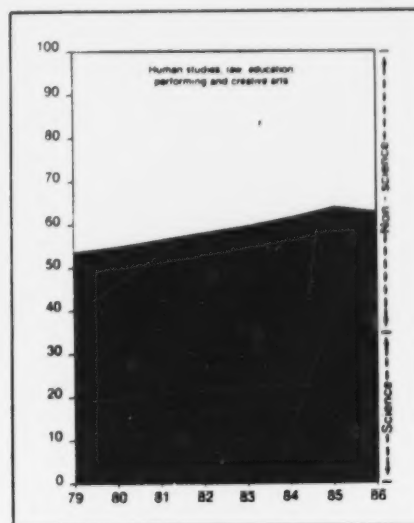
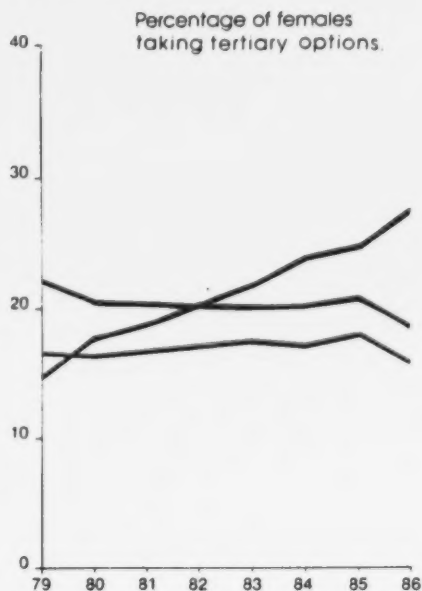
- Rapid increase in commerce, at expense of human studies etc
- Smaller increases in technology and paramedical options

commerce
paramedical
technology

COHORT FLOW



BS 79-86 Females

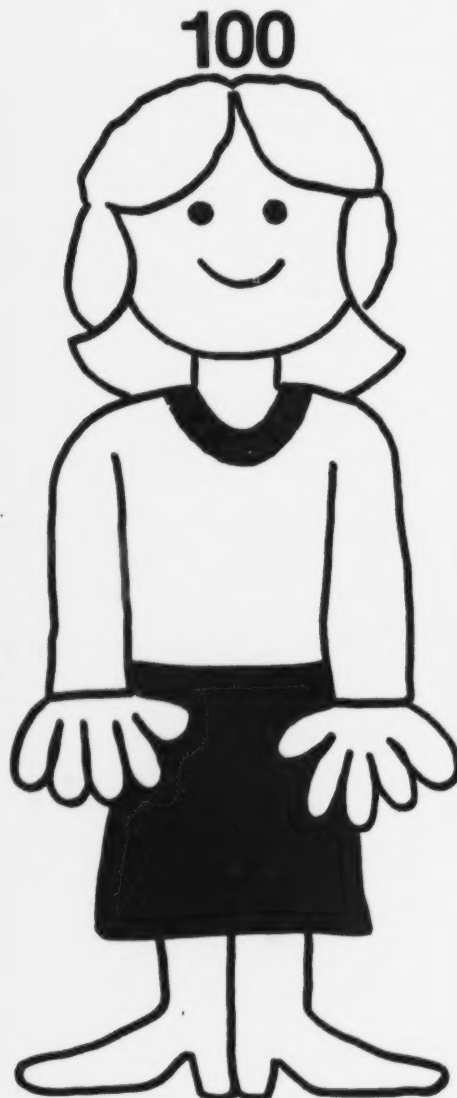
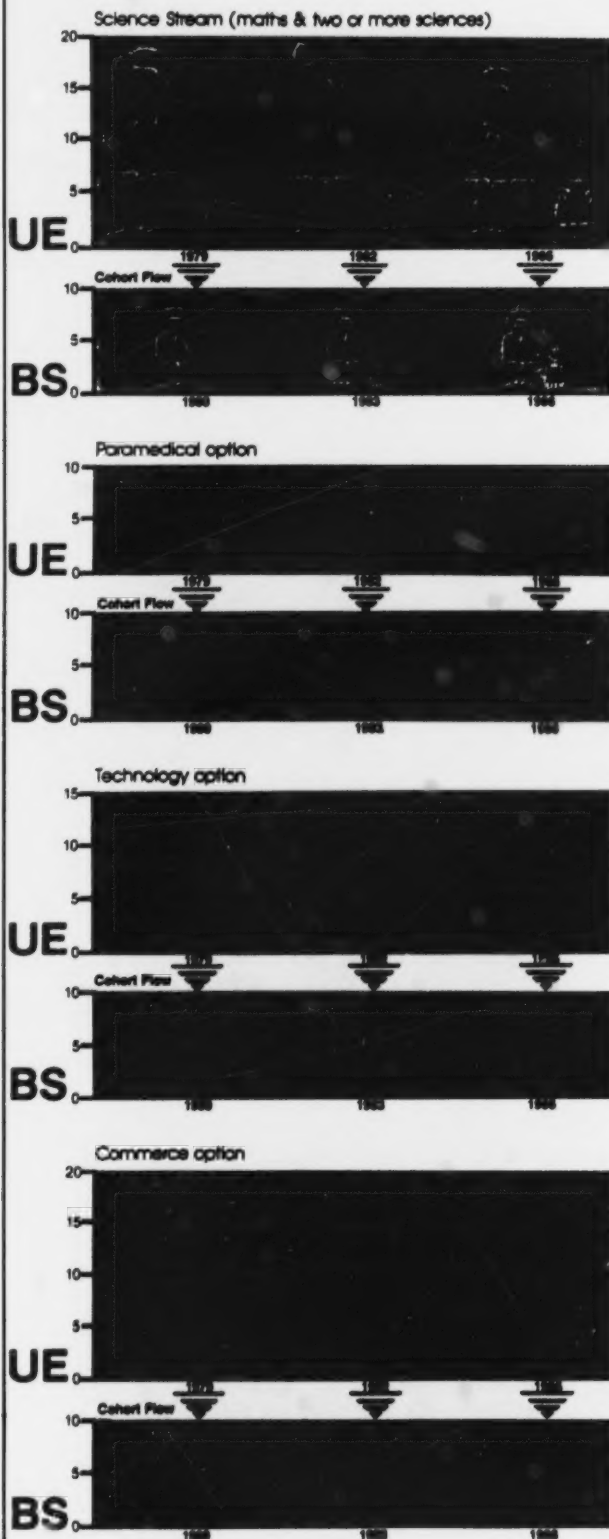


Percentage share of female tertiary options.

- Rapid increase in commerce mainly at expense of human studies etc. (see page 28)
- Decrease in both science options.

Subject selection and tertiary options

Percentage of F3 cohorts in 1976, 1979 and 1982 who progress to tertiary options at UE & BS levels.



- Decreasing proportion of Form 3 males taking technology option at UE level.
- Marginal decrease in proportion taking technology option at BS level.
- Sharp increase in proportions taking commerce at UE and BS levels.
- Increase in the proportions of Form 3 females taking technology option at UE and BS levels - but from **very low** bases.
- Significant increase in proportions taking commerce option at UE and BS levels.

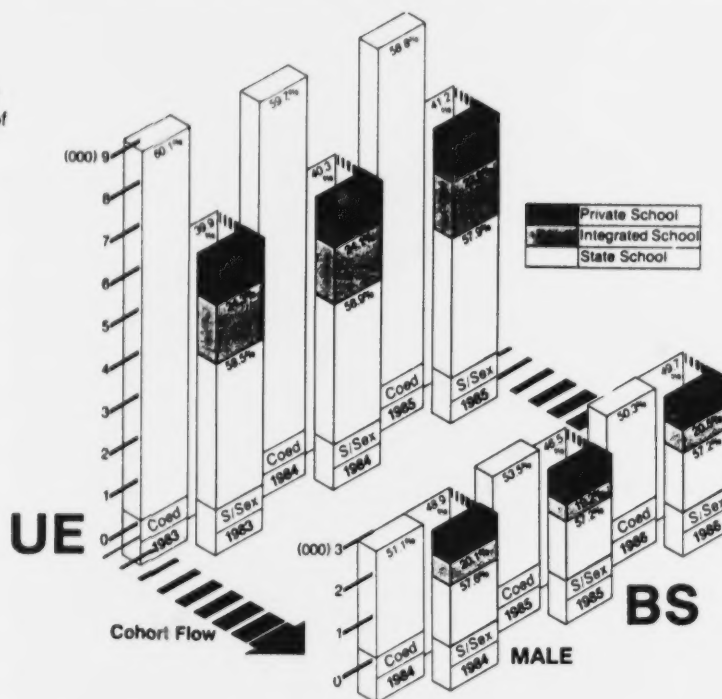
■ science option
■ paramedical option
■ technology option
■ commerce option

Subject selection and tertiary options

UE 83-85 Males

BS 84-86 Males

Percentage composition of male populations by type of school and by school authority.

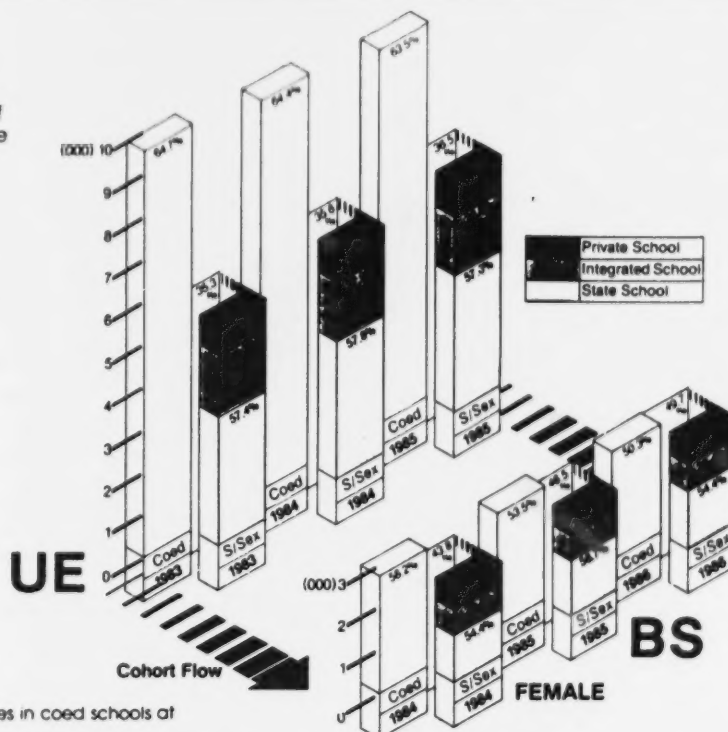


- Increase in single sex population at UE level.
- State dominates single sex schools.
- Coed and single sex populations approaching parity at BS level.

UE 83-85 Females

BS 84-86 Females

Percentage composition of female populations by type of school and by school authority.

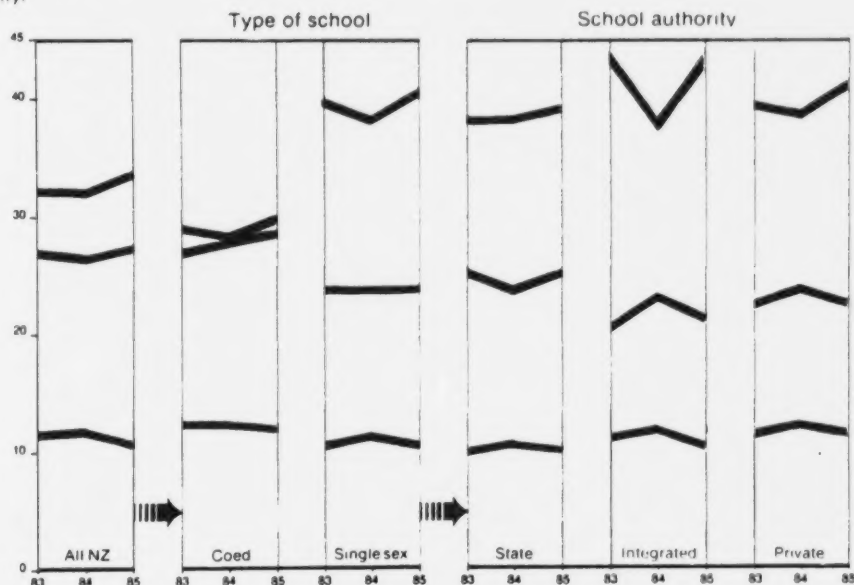


- Higher percentage of females in coed schools at UE level than males.
- State dominates single sex schools.
- Significant increase in single sex percentage at BS level over the triennium.
- Coed and single sex populations approaching parity at BS level.

Subject selection and tertiary options

UE 83-85 Males

Percentage of males taking tertiary options by type of school and by school authority.



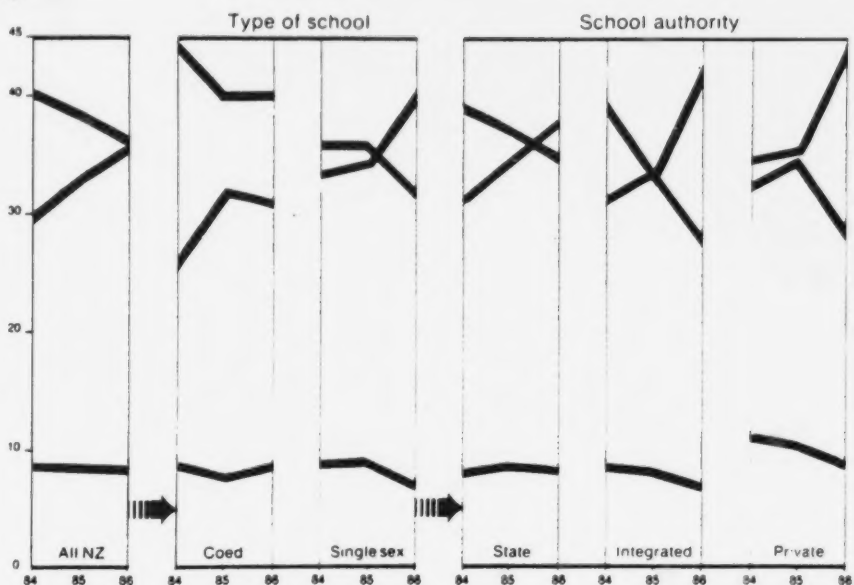
COHORT FLOW

commerce
paramedical
technology

- Higher commerce, lower science options in single sex schools.
- Slightly lower in technology option in integrated and private schools.

BS 84-86 Males

Percentage of males taking tertiary options by type of school and by school authority.



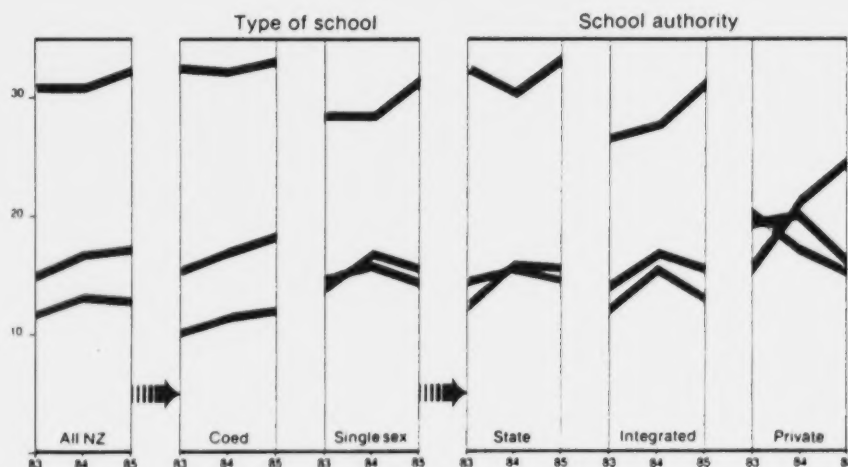
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- Higher commerce, lower science options in single sex schools.
- Higher commerce, lower science options in private schools than in state schools.

Subject selection and tertiary options

UE 83-85 Females

Percentage of females taking tertiary options by type of school and by school authority.



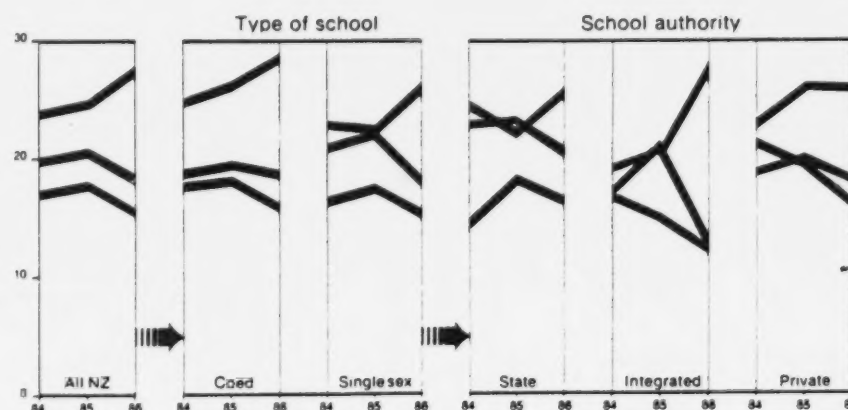
- Higher technology option in single sex than in coed schools.
- Higher technology option, lower commerce in private schools.

commerce
paramedical
technology

COHORT FLOW

BS 84-86 Females

Percentage of females taking tertiary options by type of school and by school authority.

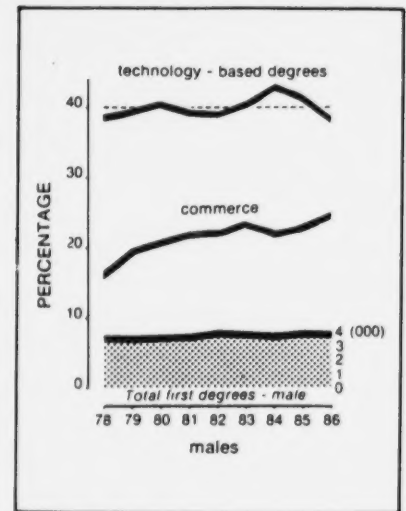
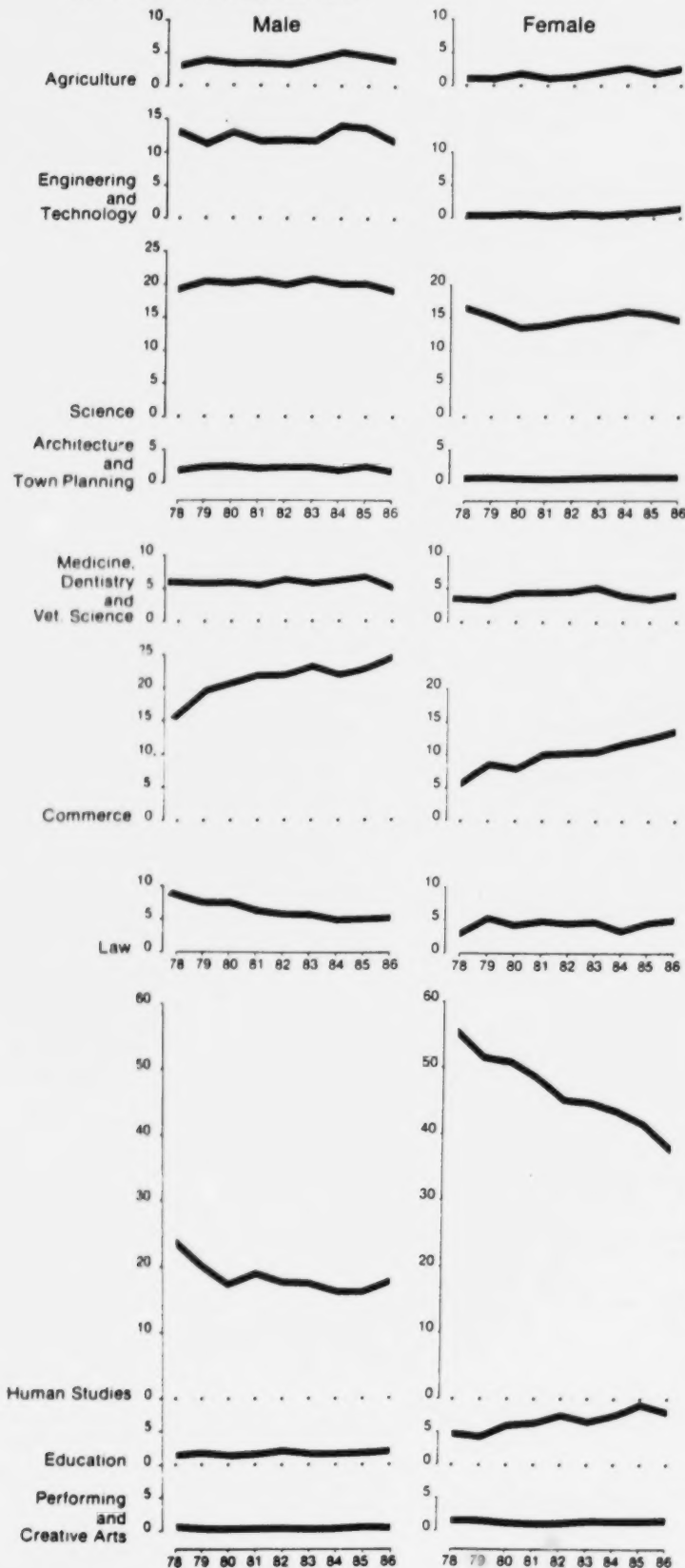


- Technology option decreasing in single sex to same level as coed.
- Commerce increasing in single sex towards level in coed.
- Decrease in technology very significant in integrated schools.

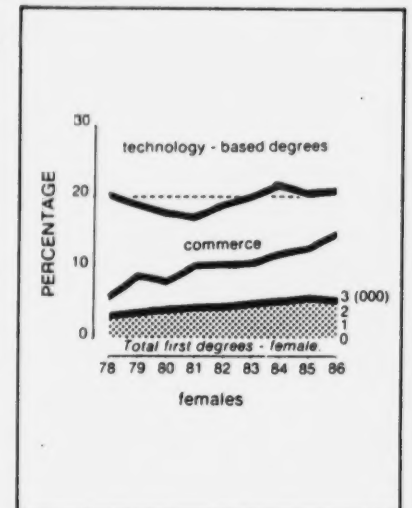
Certech

Male and Female First degrees 78-86

Percentage graduation patterns over ten selected fields.



technology - based degrees



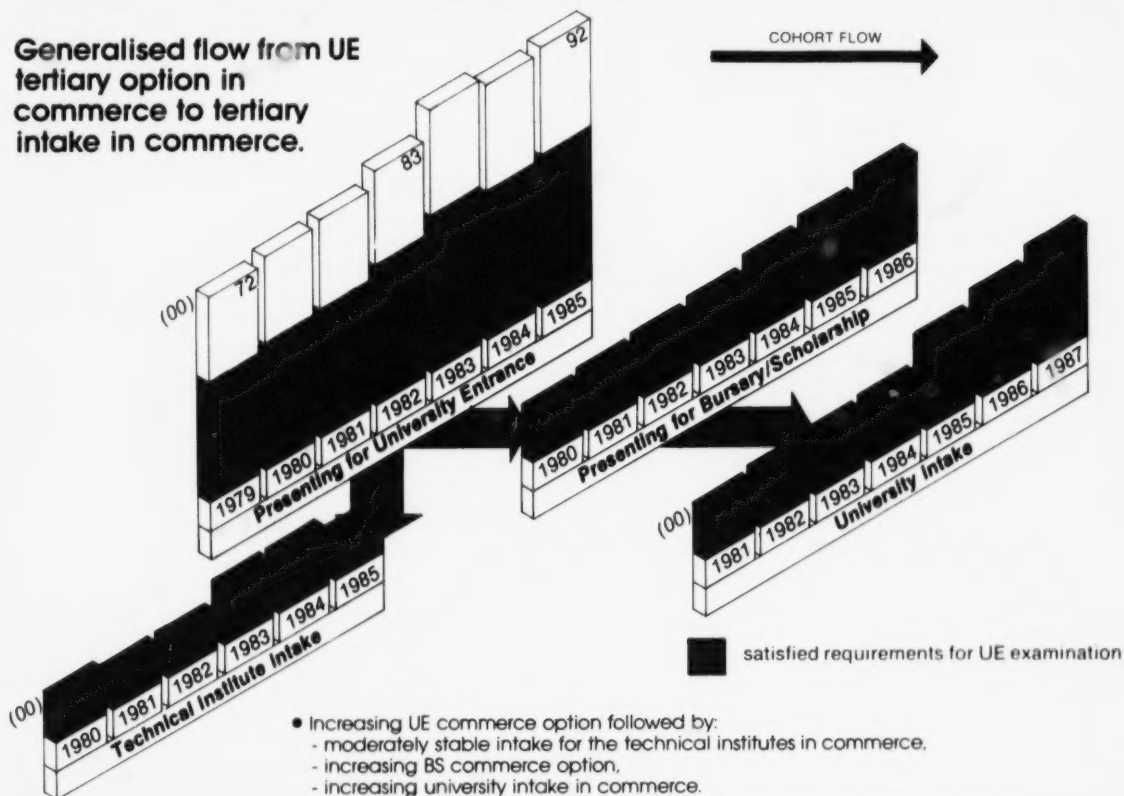
NZ and Technician Certificates in Technology



- Male increase in commerce at expense of human studies, law and more recently, technology - based degrees.
- Female increase in commerce mainly at expense of human studies.
- Total male first degrees stable since 1978 while total female first degrees mainly increasing since 1978.
- Note the decline in NZ and Technician Certificates since 1981

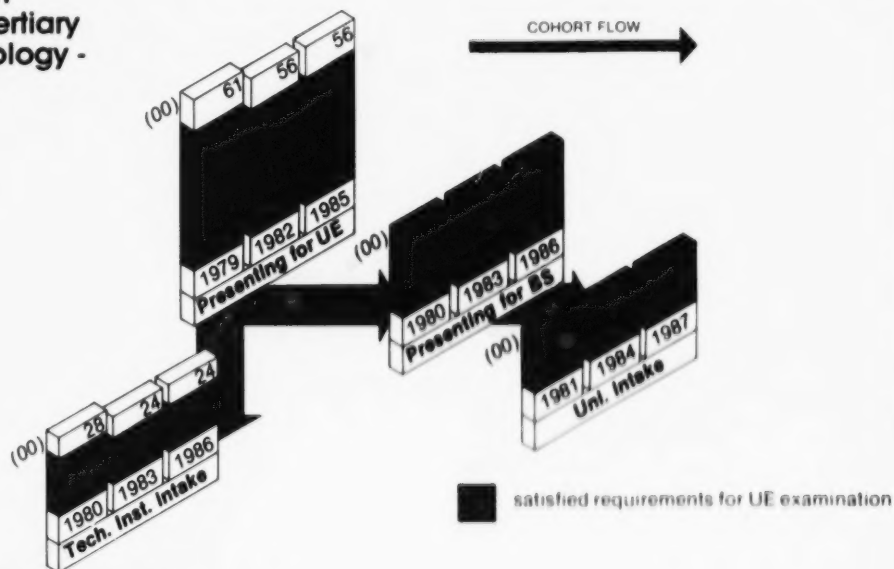
Tertiary input and output.

Generalised flow from UE tertiary option in commerce to tertiary intake in commerce.



- That is, the tertiary boost in commerce was quite predictable at the UE and BS levels.

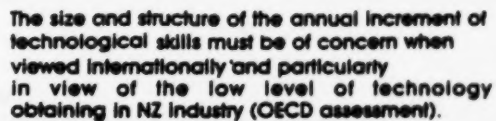
Generalised flow from UE tertiary option in technology to tertiary intake in technology - based courses.



- Decreasing UE technology option followed by:
 - decreasing intake for the technical institutes in NZ Certificates of engineering and science,
 - stable BS technology option,
 - stable university intake for technology - based degrees.

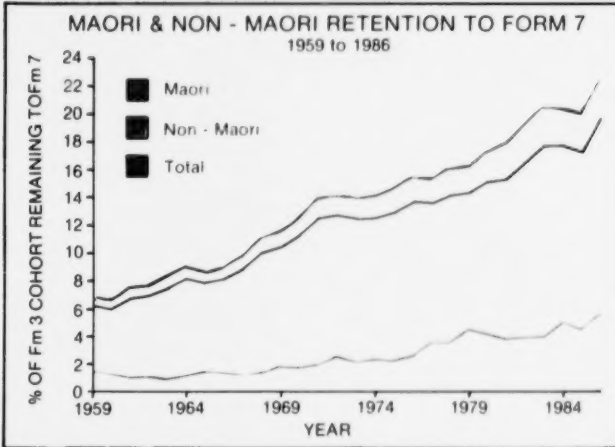
- Technical institute intake not able to be filled with those students satisfying requirements for the UE examination.
- Note how university intake in commerce exceeded university intake in technology - based degrees in 1985 and is still increasing.

Output of technological skills 1979 - 1985.



SUMMARY

"There is no substitute for plain unvarnished facts." John S. Service



NZ retention material 1959 - 1986
courtesy of :
N. Pole, Department of Education,
unpublished manuscript.

- 1 The secondary - tertiary flow is presently dominated by three factors:
 - **downward demographic trends**
 - **low retention to F6 and F7**
 - **very low productivity**

The situation is made worse when the loss of skills to Australia, particularly in technology, is also considered.

- 2 The information in this document reveals four things about secondary schooling: divergence, disparity, difference and imbalance.

Divergence. Australia and New Zealand are diverging with respect to:

- retention to the final year of high school
 - retention of maths and science subjects to the final year of high school
- The implications of this divergence are not insignificant in a CER context, particularly when coupled with the annual egress of technological skills to Australia.

Maori and non - Maori students are diverging with respect to retention to F7. The Maori population will *increase* from 12% to 20% of the NZ population by the year 2000 and this will have significant social implications. Clearly, if Maori youth are to gain knowledge - based skills and are also to adapt to and benefit from technological change then much has yet to be done to increase their very low retention rates in F6 and F7.

Disparity. Between males and females the major disparity is in the maths - science subject selections.

This has a consequent and severe limiting of tertiary options for females in technology - based courses.

Difference. Between coed schools and single sex schools different tertiary options are clear and particularly for males.

'Single sex' males *markedly* favour commerce when compared with coed males. 'Single sex' females favour science when compared with coed females.

Imbalance. A marked imbalance is revealed in subject selection where maths - science and maths - commerce subject concentrations dominate and where human studies and languages are low. Indeed, the percentage of students taking languages, history or geography at UE and BS levels have been declining for at least the last five years. If New Zealand is to compete strenuously in the world market it surely behoves us as a nation, to make sure that many young New Zealanders have an awareness and appreciation of the history, the culture and the languages of our major trading partners. This awareness/appreciation of other countries can be further developed into mutual understanding through travel, through commerce, through technology and through both organised and independent study. Recently, Professor Nakamura, policy adviser to the ruling liberal party of Japan, expressed *marked* concern about the paucity of courses offering in NZ about Japanese society or Japanese language study/appreciation. Such ignorance almost amounts to arrogance towards Japan, *our No. 1 trading partner!*

- 3 The flight to commerce.** Commerce has risen, as a percentage share of first degrees (male and female), from 13% in 1978 to 21% in 1986 and is expected to dominate graduate output by the early nineties, surpassing human studies and technology - based degrees.

The quest for relevance; the 'high profile' of business, banking and stockbroking; and the recent deregulation of the economy have probably all played a part in the march to commerce.

What seems little understood is that the dynamic nature of the financial sector, particularly the international one, depends heavily on hi - technology through computers, laser printing and the most sophisticated telecommunications.

However, in planning an education strategy for the future, emphasis *must* be placed on *wealth creation* skills rather than an over emphasis on skills concerned with the *rearrangement of wealth*.

New Zealand needs the skill of the engineer/scientist and technician as well as the skill of the lawyer and the accountant.

- 4 Output of technological skills** The output of technological skills is absolutely low. The structure of the output indicates an overdominance of graduates at the first level in comparison with NZ Certificate and Technician Certificate holders at the second and third levels.

The outflow of technological skills to Australia further weakens the technological output structure at the second and third levels.

From the tertiary intake data, graduate output will remain fairly constant over the next four years but it is expected that the output of NZ and Technician Certificates will decrease over the same period.

If the 1985 output pattern (as % of F3 cohort) is *maintained* (unlikely for the next four years) then the output of technological skills in 2000 will have decreased by 21%.

The incremental percentages with respect to the labour force in 1985 and 2000 are revealing:

	1985	2000
Output of technological skills	5012	3980
Labour force	1.4 million	1.6 million
%	0.36	0.25

Can New Zealand have a technological base to its economy with low and declining skill increments to its labour force?

BUDGET SUMMARY: education and training.

"Life is tons of discipline."

Robert Frost

	Voted	Expended.....→			
LABOUR	1988	1987	1986	1985	1984
Employment and training					
Fully subsidised	14	156	257	268	244
Job Opportunities Scheme	45	25	20	52	35
Access	225	127	40	29	11
Other	71	68	42	33	28
Labour total (L)	355	376	359	382	318
SOCIAL WELFARE					
Unemployment benefit (B)	780	709	290	274	315
Total (L + B)	1135	1085	649	656	633
EDUCATION					
Administration	67	57	37	29	25
Pre-school	58	48	28	25	24
Education support services	142	124	103	89	86
State primary schools	855	756	613	548	540
State secondary schools	738	646	479	422	400
School buildings	127	102	86	77	81
Other school operations	120	101	71	62	58
School subtotal	1841	1605	1249	1109	1079
Teacher education	76	60	41	36	45
Technical and continuing education	344	258	181	148	141
University education	498	424	361	289	274
Tertiary total (T)	918	742	583	473	460
National library	50	42	28	21	16
Gross expenditure	3076	2618	2028	1747	1690
Departmental receipts	84	23	18	18	16
Net expenditure	2993	2595	2010	1729	1674
T/(L + B)	.81	.68	.90	.72	.73

Source: Estimates of expenditure - successive Budgets Figures expressed in \$ (millions)

Observations:

- The (L + B) national cost figures reveal a sharp increase. This increase is also in individual suffering and personal tragedy.
- They also reveal a most serious loss, or underutilisation, of potential young talent just at a time when demographic data establish that the youthful age groups (15 - 19, 20 - 24) will decline by 25% between now and the end of the century.
- The ratio T/(L + B), being less than one, reflects both low retention to F6 and F7 and low productivity of the secondary - tertiary system.

Urgent questions:

- What can be achieved by the (L + B) pattern of expenditure reported above?
- Will it in fact add significantly to the national pool of knowledge - based skills particularly those in technology?
- Can it contribute to a more balanced economy?
- Can it enable NZ to increase its production of high value - added exports and services?
- Does it show a genuine investment in human resources, in the growth of flexible human value?

IMPLICATIONS

The Westminster dilemma—

"Even the dogs may eat of the crumbs which fall from the rich man's table; and in these days, when the rich in knowledge eat such specialised foods at such separate tables, only the dogs have a chance of a balanced diet." Sir Geoffrey Vickers.

● **An ageing population and declining secondary school rolls matched by a demand for knowledge - based work skills raises serious questions about NZ's future. Where can the necessary pool of talent be found?**

Through increased retention to F6 and F7. This requires urgent consideration being given to:

- quality of offering, eg. core curriculum comprising, say, English, history, language, 1 maths and 1 science. Tertiary institutions could accept the subject array for technology - based courses. Such a curriculum would: give better educational balance; keep options open and provide equity of options (note p.8)
- incentives to continue, eg. financial support from aged 16 to at least first degree/certificate.
- structural features, eg. senior colleges from F5 like Europe and the Australian Capital Territory.
- the impact of technological change on employment and training requirements, eg. the hierarchy of knowledge and skills required to support the primary and manufacturing sectors.
- better counselling on post - school options, eg. the need to fully utilize a limited pool of skilled human resources through a well organised and co-ordinated network of vocational counselling available to students, parents and teachers.

Through more flexibility. Involving co-operation between secondary school and tertiary levels and within the tertiary sector to ensure a shared response to individual and national needs.

● **Scholarships to be offered for maths - science teachers, and, following the IEA study, particularly for specialist maths teachers at primary level.**

● **Establish tertiary learning centres offering long vacation preliminary/introductory courses in maths, chemistry and physics which can be followed by one year transitional/bridging courses enabling students with inadequate maths - science backgrounds, particularly females, to proceed with technological courses.**

- After the preliminary/introductory course, students could move either to a technical institute or a university. Such courses would entitle students to receive grants. Such centres would specialise in mastery learning employing CAI (computer aided instruction), modular learning and video presentations with strong back - up from tutorial staff.
- Such centres could offer special courses to selected high school students and also to teacher college trainees.

● **Extension by one year of courses leading to technological awards. Courses would be specially designed to reach the same level of competence, but over an extended period.**

● **Australia and NZ face a common problem with respect to the world economy: they both have to make a major shift from resource - based exports to "brain - based" exports with technology being the key to prosperity.**

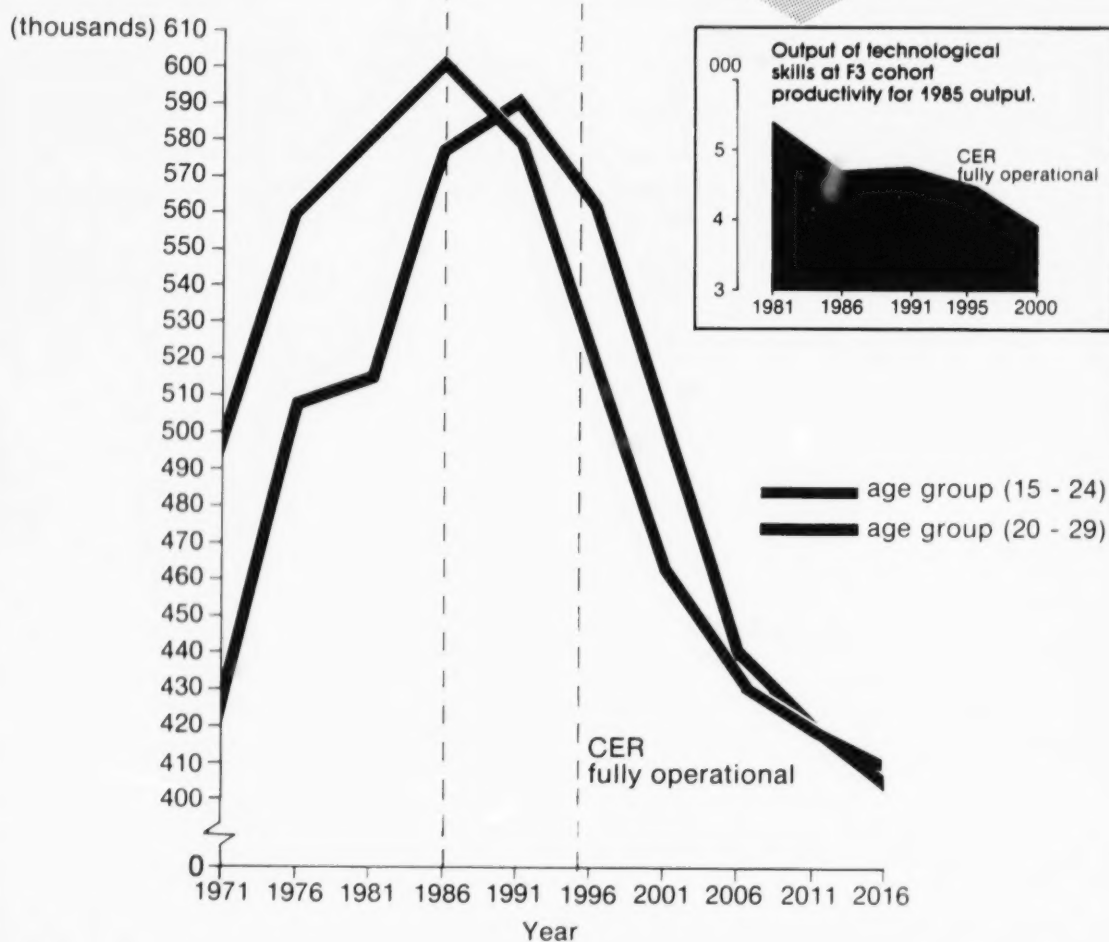
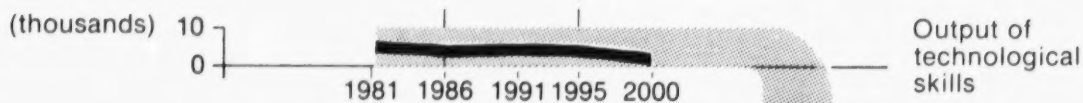
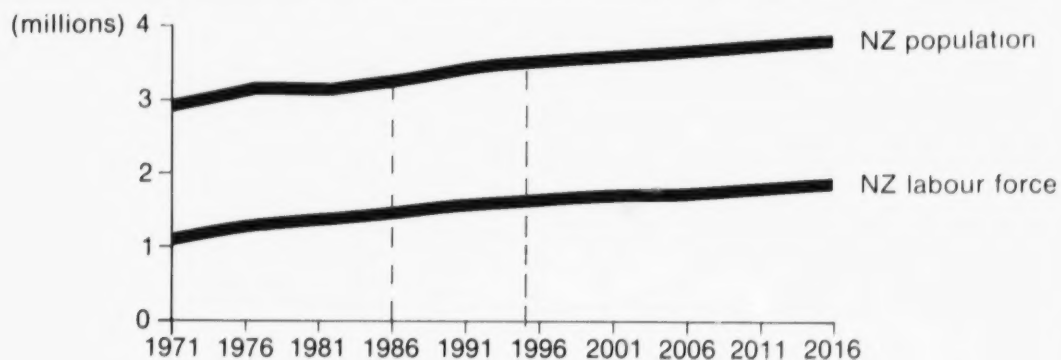
- In 1988 CER is to be reviewed. Questions of rationalisation, the funding of education and training in the region, particularly in technology, will be important especially with a common labour market to which NZ contributes significant skills.
- In 1995 CER is fully operational. Now is the time to discuss CER as a common education region.

● **National flow statistics to be generated from:**

F3→F4→F5→F6/F7→tertiary input→tertiary output→employment as a computer - based system for management information and to aid counselling.

Such a system should be compatible to comparable Australian systems.

Demographic Change: 1971 - 2016
(assumptions: medium fertility and zero migration)



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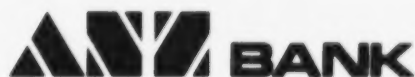
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New Zealand Ltd**

NZFP Technology Limited

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The Challenge to the CER Region

"To compete effectively in world trade the CER Region will have to make a fundamental change in economic and technological direction requiring considerable long term commitment, planning and collaboration on the part of industry, government and education institutions."

(Certech: "The Supply of Technological Skills to a Changing Economy.") 1986 p.9